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June 29, 2012

CERTIFIED MAIL 7004 2510 0005 0061 8508
RETURN RECEIPT REQUESTED

Mr. Donald A. Heller
Corrective Action Section 1
Remediation and Reuse Branch
U.S. EPA, Region 5
77 W. Jackson Boulevard (LU-9J)
Chicago, Illinois 60604-3590

Response to EPA Letter Dated June 7, 2012
Bench/Pilot Study and CSIA Study Work Plans
Eli Lilly and Company - Evonik Degussa Corporation, Tippecanoe Laboratories
Facility ID Number IND 006 050 967

Dear Mr. Heller:

Eli Lilly and Company (Lilly) has prepared this response to comments issued by the U.S. Environmental Protection Agency (U.S. EPA) on June 7, 2012. Attachment 1 contains Lilly response to each comment. Lilly has also provided an updated Bench-Scale and Pilot-Scale Treatability Study Work Plan in Attachment 2, which includes modifications as described in Attachment 1.

Lilly appreciates your continued input in implementation of an effective and efficient remedial approach at Tippecanoe Laboratories. If you have any questions or comments on the provided information, please contact me at (317) 276-8989.

Sincerely,

Philip L. Shinn, P.E.
Corrective Action Project Manager

cc: Doug Griffin – IDEM (w/Enclosure)

Attachments: Attachment 1 – Response to Comments
Attachment 2 – Bench-Scale and Pilot-Scale Treatability Study Work Plan

ATTACHMENT 1

RESPONSE TO COMMENTS
U.S. EPA JUNE 7, 2012 LETTER

REVISED COMPOUND SPECIFIC ISOTOPIC ANALYSIS (CSIA) WORK PLAN

AND

REVISED BENCH–SCALE AND PILOT-SCALE TREATABILITY STUDY WORK PLAN

General Comment on Bioremediation Pilot-Scale Treatability Study:

Comment: It appears that the Response Letter has addressed the previous comments appropriately, in general.

However, the details provided on the planned bioremediation part of the pilot study are lacking. The details of the bioremediation part of the pilot study should be included, and the process and approach for choosing the bioremediation details (e.g., the "bioenhancement chemical", injection rates, volumes/masses, etc.) should be discussed. There are a few generalities mentioned in Tables 7, 8, and 9 of Attachment 3: e.g.;

> "Estimated Bioenhancement Dosage
> To Be Determined Following Bench-Scale, dependent upon chemical oxidant dosage, and monitoring conducted during the oxidant phase of the pilot-scale testing."

However, these generalities are not enough to judge the validity of the approach. Details should be provided showing how and on what basis these decisions will be made. Previous documents ("Attachment 1: Response to Comments" of a previous version (dated November 21, 2011) of the Work Plan submitted for review) have alluded to possible bioremediation reagents and approaches, and the 1.4 PRELIMINARY DESIGN section of the Revised Work Plans mentions a few details about the expected full-scale approach, but more details could be provided about the expected pilot study.

Also, perhaps a letter report could be provided immediately after the pilot scale ISCO effort, showing the results of the ISCO pilot and giving the plans/details of how the bioremediation pilot will be revised/conducted (i.e., as based on ISCO results, as implied in the generalities quoted above).

Response: Lilly concurs that a brief letter report should be provided immediately after the pilot scale ISCO effort, which will provide some preliminary results of the ISCO phase of the Pilot-Scale Test to the extent that the ISCO results will modify or refine the scope of the bioenhancement phase of the Pilot-Scale Test.

Lilly has also provided additional detail regarding the bioremediation pilot in the enclosed Revised Bench-Scale and Pilot-Scale Treatability Study Work Plan. However, Lilly does not believe that further detail beyond what is provided in the enclosed Work Plan is necessary at this time. There will be two additional opportunities, when more information is available, for refinement of the scope of the bioenhancement phase of the Pilot-Scale Test.

The first opportunity will be after the Bench-Scale Test, when a chemical oxidant and bioremediation product will be recommended within the Bench-Scale Technical Memorandum. The choice of chemical oxidant will have an impact on the selection of a bioremediation product, as well as the timing and dosage of the product during the Pilot-Scale Test. Design factors to be considered in selection and dosing of the bioenhancement product include:

- Effectiveness in reducing primary COC concentrations based on a literature search and relevant experience;
- Anticipated COC concentrations remaining after the ISCO phase of Pilot-Scale Test, based on Bench-Scale results;
- Experience with various ISCO/bioenhancement chemical combinations (compatibility);
- Impact of selected oxidant on bioenhancement and MNA; and,
- Bioenhancement chemical costs.

The second opportunity for refinement of the scope of the bioenhancement phase of the Pilot-Scale Test will be after the ISCO phase of the Pilot Test. At that time, observed changes in geochemical parameters will have provided an improved understanding of the subsurface flow paths under injection conditions than is currently understood, and there will be a preliminary indication as to how much benefit the ISCO phase of the Pilot Test will have provided. The brief letter report, as discussed above, will include final design parameters for the bioenhancement phase of the Pilot-Scale Test.

Specific Comments on CSIA Work Plan:

Pgs 3, 12, 13: "For reactions that conform to the Raleigh equation..."

In reference to the Rayleigh equation commonly used in CSIA work, the spelling is Rayleigh, not Raleigh.

Response: Lilly has corrected the spelling in the work plan in Attachment 2.

Page 12: "For benzene and chlorobenzene, significant increases in $\delta^{13}C$ and $\delta^{2}H$ can provide evidence of biological degradation. The threshold for significance is generally taken to be a change of 2‰ or greater."

While the analytical uncertainty associated with determination of $\delta^{13}C$ is often considered to be around +/-0.5‰, so that a 2‰ threshold of significance is reasonable, the analytical uncertainty associated with determination of $\delta^{2}H$ is higher (often considered to be around +/-5‰; see Hunkeler et al. (2008), p9 and p31), so the threshold for $\delta^{2}H$ should be higher than for $\delta^{13}C$ – at least 10‰. Note that the $\delta^{13}C$ uncertainty is around 0.5‰, and the current approach is to use a 2‰ threshold (i.e., four times higher), so the $\delta^{2}H$ threshold might be reasonably moved to 20‰.

Response: Duly noted, the $\delta^{2}H$ threshold will be revised to 20‰.

Specific Comments on Bench-Scale and Pilot-Scale Treatability Study Work Plan:

Page 54: "The bioenhancement injection program will be conducted approximately four weeks after the completion of the oxidant injection program within each of the three source areas."

How was this time frame decided? Are there measurements that will be made to decide when to initiate the bioenhancement injection program.

Response: The four week time frame was estimated as the least amount of time that would allow for collection of data during the ISCO phase of the Pilot Test and allow for the chemical oxidant to reach locations at least 30 feet down-gradient of the injection points. The estimate was based on the calculation described in section 4.1 and summarized in Tables 1, 2 and 3 of the Work Plan. It was anticipated that this time frame could be revised outward based on the results of both the Bench-Scale Test and the ISCO phase of the Pilot Test. Furthermore, with the addition of a letter report submittal between the ISCO and bioremediation phases, it is likely that more analysis and review time would be needed. Therefore, the time frame has been adjusted from four weeks to twelve weeks.

Again, this time frame may be revised based on the results of the Bench-Scale Test and the ISCO phase of the Pilot Test.

Page 56: "Information regarding the ability to deliver the required amount of material to the treatment zone in each injection interval for the source area and down-gradient area will be based on field conditions."

The meaning of this sentence is not clear.

Response: Section 4.4.2 has been revised to clarify that a proposed Pilot-Scale application dosage will be determined following the Bench-Scale Test, and proposed in the Technical Memorandum. This dosage will be determined based upon expected field conditions, COC concentrations within each Pilot Area, and the results of the Bench-Scale Test.

However, injection rates will have to be determined in the field during the Pilot-Scale Test at each location. Until that time, the ability to inject proposed volumes of material into the treatment zones will not be known.

Similar injection rates will likely be assumed for the bioenhancement product injection as what are achieved during the ISCO phase of the Pilot-Scale Test.

Data collected during both phases of the Pilot-Scale Test will be used to refine the dosages and injection rates to be used during the full-scale implementation.

Pages 61, 64, and 66: Tables 10, 11, and 12:

"Three Months After Bioenhancement Injection:
Temperature, pH, specific conductance, DO, ORP, VOCs, SVOCs, metals, alkalinity, ammonia, carbon dioxide, chlorides, ferrous and dissolved iron, manganese, methane, nitrate, sulfate, fluoride, and aniline"

It is not clear why all of these parameters are not measured before bioremediation starts (for background measurements), and during the bioremediation pilot, rather than just toward the end. It is of considerable interest to track the changes in geochemistry from before the bioremediation study to the end of the study, so that the evolution of Site conditions (i.e., after ending eh ISCO effort) through the implementation of the bioremediation effort (e.g., injection bioremediation

reagents and afterwards) can be understood in relation to the effectiveness of the bioremediation effort. Knowledge of these changes should help in design, monitoring, and prediction of the effects of the full-scale bioremediation effort, and of the later MNA phase. Also, TOC should be included.

Response: Tables 10, 11, and 12 have been revised to include the full suite of parameters immediately before bioenhancement injection, one month after bioenhancement injection, two months after bioenchancement injection, and three months after bioenhancement injection.

Also, TOC has been included.

ATTACHMENT 2

BENCH-SCALE AND PILOT-SCALE TREATABILITY STUDY WORK PLAN

REVISED BENCH-SCALE AND PILOT-SCALE TREATABILITY STUDY WORK PLAN
ELI LILLY & COMPANY

FOR THE PROPERTY LOCATED AT:
EVONIK DEGUSSA CORPORATION
TIPPECANOE LABORATORIES
1650 LILLY ROAD
LAFAYETTE, TIPPECANOE COUNTY, INDIANA

JUNE 28, 2012

NEWFIELDS
2850 Lake Vista Drive, Suite 140
Lewisville, Texas 75067
Tel: (972) 956-9100 - Fax: (972) 956-9198
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ATTACHMENTS

ACRONYM AND ABBREVIATION SUMMARY

AST	aboveground storage tank
ASTM	American Society for Testing and Materials
bgs	below ground surface
BOD	biological oxygen demand
BTEX	benzene, toluene, ethylbenzene, and total xylenes
C_6H_6	benzene
C_6H_5Cl	chlorobenzene
C_4H_8O	THF
$C_{10}H_{15}N$	n,n-DEA
CaO_2	calcium peroxide
CAS No.	Chemical Abstracts Service Registry Number
CB	chlorobenzene
$ClC_6H_4CF_3$	pCBT
CMS	Corrective Measure Study
CO_2	carbon dioxide
COC	constituent of concern
COD	chemical oxygen demand
DO	dissolved oxygen
DTW	depth to water
EPC	end-point criteria
ERC	Environmental Restrictive Covenant
Evonik	Evonik Degussa Corporation
Fe	iron
Fe(II)	ferrous iron
Fe(III)	ferric iron
ft	feet
g/L	grams per liter
gpm	gallons per minute
HO_2	perhydroxyl radical
H_2O_2	hydrogen peroxide
ID	identification
ISCO	In-Situ Chemical Oxidation
$KMnO_4$	potassium permanganate
Lilly	Eli Lilly and Company
mg/L	milligrams per liter
ml	milliliter
Mn^{+2}	manganese
MNA	monitored natural attenuation

ACRONYM AND ABBREVIATION SUMMARY (CONTINUED)

MnO_2	manganese dioxide
MnO_4^-	permanganate
MSDS	Material Safety Data Sheets
msl	mean sea level
$NaMnO_4$	sodium permanganate
NAPL	non-aqueous phase liquid
$Na_2S_2O_8$	sodium persulfate
n,n-DEA	n,n-diethylaniline
O_2	oxygen
O_3	ozone
OH	hydroxide ion
ORC®	Oxygen Release Compound®
ORC-A®	Oxygen Release Compound – Advanced®
ORP	oxygen reduction potential
pCBT	p-chlorobenzotrifluoride
PID	photo-ionization detector
POC	point-of-compliance
ppm	parts per million
psi	pounds per square inch
QAPP	Quality Assurance Project Plan
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
$S_2O_8^{2-}$	persulfate
SDWA	Safe Drinking Water Act
Site	Tippecanoe Laboratories
SO_4^-	sulfate radical
SVOCs	semi-volatile organic compounds
THF	tetrahydrofuran
TOC	total organic carbon
TOD	total oxidant demand
µg/L	micrograms per liter
UIC	Underground Injection Control
USAF	U.S. Air Force
USCS	Unified Soil Classification System
U.S. EPA	United States Environmental Protection Agency
VOA	volatile organic analysis
VOCs	volatile organic compounds

1.0 INTRODUCTION

This Bench-Scale and Pilot-Scale Treatability Study Work Plan was developed as part of the Corrective Measure Study (CMS) process at the Evonik Degussa Corporation's (Evonik's) Tippecanoe Laboratories ("Site") located at 1650 Lilly Road in Lafayette, Tippecanoe County, Indiana [formerly owned and operated by Eli Lilly and Company (Lilly)]. Based on current Site conditions, the success of prior remedial measures, and evaluation of applicable remedial response measures; targeted spot treatment utilizing in-situ chemical oxidation (ISCO) followed by a bioenhanced natural attenuation program in three discrete "source" areas has been tentatively identified as appropriate for implementation of a remedial response. However, prior to implementation of the targeted spot treatment program, all parties agreed that Bench-Scale and Pilot-Scale Treatability Studies of various ISCO technologies were appropriate to further evaluate the approach proposed in the Revised CMS Report submitted on January 14, 2011. In addition, the bioenhanced natural attenuation program will be assessed as part of Pilot-Scale Treatability Study.

On November 21, 2011, Lilly submitted a Bench-Scale and Pilot-Scale Treatability Study Work Plan to the U.S. Environmental Protection Agency (U.S. EPA) for review. On February 17, 2012, U.S. EPA issued a comments memorandum to Lilly; therefore, this Work Plan has been modified to address comments included in the referenced memorandum.

1.1 SITE SETTING AND GEOLOGY

The Site is located at 1650 Lilly Road in Lafayette, Tippecanoe County, Indiana and was previously owned and operated by Lilly (see Figure 1). The Site and its Resource Conservation and Recovery Act (RCRA) permit were transferred to Evonik effective January 1, 2010. The Site has been developed with fermentation and chemical synthesis facilities for the manufacture of pharmaceutical and animal health products.

The Main Plant area of the Site is located on a plateau bounded by incised valleys on the north, south, and west created by the Wabash River and Big Wea Creek drainage features. The plateau, at an elevation of approximately 620 feet above mean sea level (msl), is over 100 feet above the Wabash River.

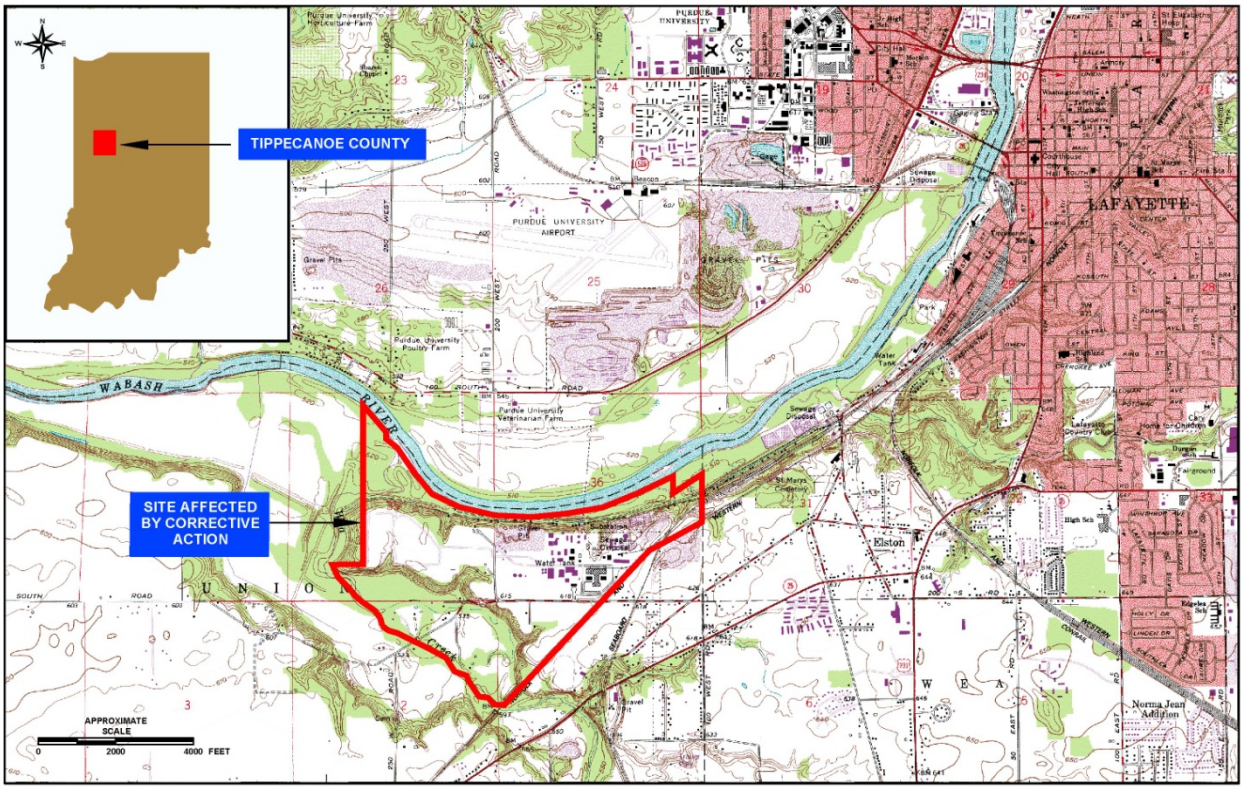

Figure 1 – Site Location

This section provides a general description of the geology and hydrogeology at the Site. A more detailed geologic description of the Site is provided in the Revised CMS Report, which was submitted to the U.S. EPA in January 2011, as well as previous investigation reports.

Figure 2 presents a cross-section that depicts the geology underlying the Main Plant. The bedrock surface is located approximately 220 feet below the ground surface (bgs) in the Main Plant area. An interval of sand and gravel, designated as Unit I is present beneath the Main Plant from the surface to a depth of approximately 65 feet bgs. Located beneath Unit I is a clayey till unit designated as Unit II that is up to 80 feet thick. Discontinuous lenses of fine silty sand have been described within Unit II. Unit II, which has been eroded away in both the Floodplain and the Wabash River drainage feature, is underlain by an interval of sand and gravel designated as Unit III that extends to the top of bedrock. Groundwater within the Unit I aquifer beneath the northern portion of the Main Plant flows in a northerly direction, discharges to the Unit IV

aquifer in the Floodplain, and then discharges to the Wabash River. Groundwater within the Unit I aquifer beneath the southern portion of the Main Plant flows in a southwesterly direction towards the Big Wea Creek drainage feature, and discharges to the Unit III aquifer.

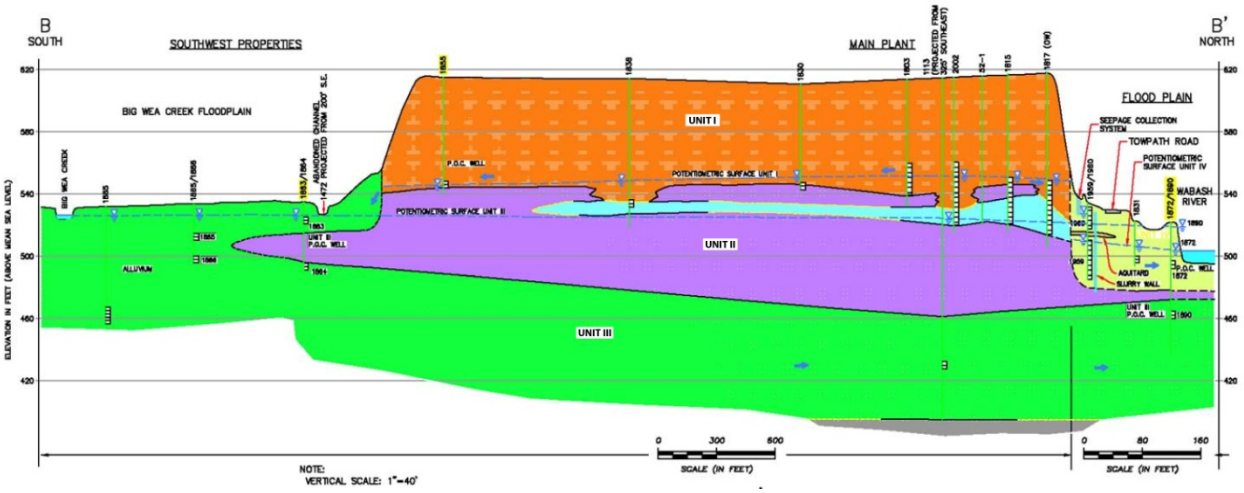

Figure 2 – Main Plant Cross-Section

The Floodplain is at an elevation of approximately 510 feet above msl, which is approximately 10 to 20 feet lower in elevation than the Big Wea Creek drainage feature. In the Floodplain, the sandy soils are intermixed with clayey deposits designated as Unit IV. Figure 3 presents a cross-section depicting the geology underlying the Floodplain adjacent to the Wabash River.

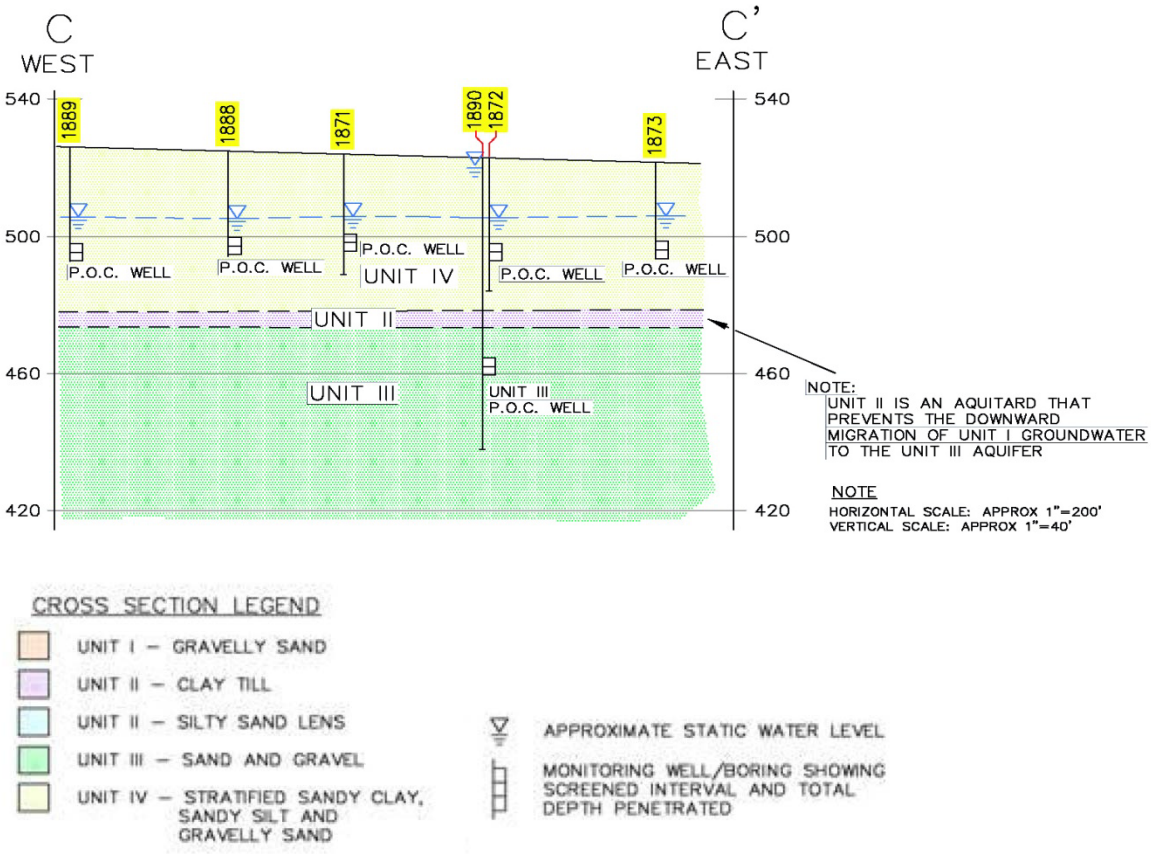

Figure 3 – Floodplain Cross-Section

As presented in the Revised CMS Report, several wells, including monitor well 1831, are located along the axis of a buried erosional feature on the upper surface of the Unit II aquitard in the Floodplain. Site assessment activities completed by Lilly during the 1980s revealed that the upper surface of the Unit II till aquitard is irregular and includes a buried erosional feature located under the bluff, north of the Main Plant and extending northward beneath the Floodplain (see the *Phase E Site Assessment Report* completed by Harza, 1989).

1.2 PROPOSED REMEDIAL APPROACH

Remediation of constituent of concern (COC) concentrations in groundwater using ISCO involves injecting chemical oxidants and potentially co-amendments directly into the saturated zone of the source area and hydraulically down-gradient portions of the COC plume. The chemical oxidants react with the COCs, eventually producing innocuous substances such as carbon dioxide and water; however, there may be chemical reaction steps required to reach those end points. In most cases, if an adequate oxidant dose is applied, the reactions proceed to completion, and the end products are reached quickly.

There are two main advantages of using ISCO over other conventional treatment technologies: large volumes of waste material are not usually generated, and treatment is commonly implemented over a much shorter time frame. Both of these advantages often result in savings on waste material disposal, monitoring, and maintenance.

ISCO has been used successfully to remove significant contaminant mass from saturated soils and groundwater at numerous sites for over two decades. Using a variety of oxidants, such as permanganate (MnO_4^-), hydrogen peroxide (H_2O_2), persulfate ($S_2O_8^{2-}$), iron (Fe – Fenton-driven, or H_2O_2-driven), ozone (O_3), and proprietary products (i.e., RegenOx^{TM}), success has been documented on a wide variety of COCs, including primary COCs at the Site. However, following a single application of an oxidant, rebound of dissolved COCs is typical. Therefore, it is common to perform multiple injections and/or follow these injections with injection of a bioremediation enhancement product to promote natural attenuation. Bioenhancement injection will be included within the Pilot-Scale Treatability Study, but will not be included within the Bench-Scale Treatability Study, since it may be very difficult to reproduce bioremediation activities in the laboratory that are representative of field conditions, due to the complexity of the chemicals and bioremediation processes involved.

As presented in the U.S. EPA ISCO Engineering Issue Paper published by Scott G. Huling and Bruce E. Pivetz, the following potential advantages and disadvantages of ISCO must be assessed prior to implementation:

Advantages

- ISCO is applicable to a wide range of contaminants.
- Contaminants are destroyed in-situ.
- In-situ treatment may reduce costs incurred by other technologies such as pump and treat, monitored natural attenuation (MNA), etc.
- Aqueous, sorbed, and non-aqueous phases of contaminants are transformed.
- There is enhanced mass transfer [enhanced desorption and non-aqueous phase liquid (NAPL) dissolution].
- Heat from H_2O_2 reactions enhances mass transfer, reaction rates, and microbial activity.
- ISCO potentially enhances post-oxidation microbial activity and natural attenuation.
- ISCO is typically cost competitive with other candidate technologies.
- ISCO is a relatively fast-acting treatment technology.

Disadvantages

- ISCO applications may incur oxidant delivery problems due to reactive transport and aquifer heterogeneities.
- Natural oxidant demand may be high in some soil/aquifers, resulting in inefficiency.
- Some oxidants have a short persistence due to fast reaction rates in the subsurface.
- There are health and safety issues regarding the handling of strong oxidants.
- There may be a potential for contaminant mobilization.
- There may be a potential for permeability reduction.
- There are limitations for application at heavily contaminated sites.
- Contaminant mixtures may require treatment trains.
- ISCO may have less oxidant/hydraulic control relative to other remedial technologies.

Complete and instant chemical oxidation of organic contaminants does not occur within the complex environment of the contaminated subsurface. Chemical oxidation is a sequential process taking the parent target contaminant through a series of partially oxidized intermediate daughter products on the path to complete oxidation. The oxidized intermediates formed are typically more biodegradable than the parent. Therefore, after completing implementation of an ISCO program, stimulation of in-situ bioremediation is commonly applied to promote natural attenuation of the remaining constituents. In-situ bioremediation through the use of an injected substrate has long been recognized as a very cost effective technology for achieving low contaminant concentrations when applied to dissolved-phase COC plumes. A variety of substances have been utilized to provide nutrients and energy sources to the existing microorganisms to enhance the bioremediation process. These substances may include gaseous air/oxygen, lactate, molasses, vegetable oil, nitrates, and/or proprietary products [i.e., Oxygen

Release Compound (ORC®)]. A combination of ISCO with bioenhanced natural attenuation has been tentatively selected as an appropriate remedial approach for the Site.

1.3 PRIMARY COCs

The five primary COCs at the Site are benzene, chlorobenzene (CB), p-chlorobenzotrifluoride (pCBT), tetrahydrofuran (THF), and n,n-diethylaniline (n,n-DEA); however, in addition to these COCs, additional volatile organic compounds (VOCs) are present within the plumes that will be treated. Therefore, the implementation of any treatment program must take into account the mass of these additional constituents and their potential impact on the effectiveness of the treatment program. Presented below is a summary of the five primary COCs. Additional information regarding potential biotreatment and MNA processes for the primary COCs was previously provided in the MNA Work Plan dated April 9, 2009.

Benzene

CAS No.: 71-43-2
Composition: C_6H_6
Description: A natural constituent of crude oil that is a colorless and highly flammable liquid with a sweet smell and a relatively high melting point.
Use: Additive in gasoline, industrial solvent, precursor in the production of drugs, pesticides, plastics, synthetic rubber, and dyes.
Fate: Evaporates into the air very quickly.
Dissolves slightly in water.
Breaks down slowly in water and soil.
Can pass through the soil into groundwater.
Does not build up in plants or animals.

CB:

CAS No.: 108-90-7
Composition: C_6H_5Cl
Description: Colorless, flammable liquid with an aromatic, almond-like odor and a high boiling point.
Use: Common solvent and a widely used intermediate in the manufacture of other chemicals (such as herbicides, dyestuffs, and rubber). It was also once used in the manufacture of certain pesticides and the main precursor for the manufacture of phenol.
Fate: Readily evaporates into air.
Some will dissolve in water.
Broken-down rapidly by bacteria in soil.
Does not build up in the food chain.

pCBT:

CAS No.:	98-56-6
Composition:	$ClC_6H_4CF_3$
Description:	Colorless liquid with a distinct aromatic odor.
Use:	Used as an ink solvent the printing industry and as an intermediate in agrochemicals and pharmaceuticals.
Fate:	Will preferentially partition to the atmosphere, due to its high volatility. The low solubility would limit its potential impact to aquatic systems. Will rapidly volatize from dry and moist soils. Moderate level of bioaccumulation.

THF:

CAS No.:	109-99-9
Composition:	C_4H_8O
Description:	Colorless, water-miscible organic liquid with low viscosity at "room" (standard) temperature and pressure.
Use:	Common solvent for polar reagents, can be used in hydroboration reactions to synthesize primary alcohols, and as a solvent for organometallic reactions such as organolithium and Grignard reactions. Can be used to dissolve rubber, plastics, and to degrease metal parts.
Fate:	When released into the air, THF may be removed from the atmosphere to a moderate extent by wet deposition. When released into the soil, THF is expected to quickly evaporate. When released into water, THF may biodegrade to a moderate extent. Not expected to significantly bioaccumulate.

n,n-DEA:

CAS No:	91-66-7
Composition:	$C_{10}H_{15}N$
Description:	It is a colorless to yellow liquid that is viscous and oily. Commonly prepared by the ethylation of aniline.
Use:	Uses include dyes, pharmaceuticals, pesticides, herbicides, and explosives.
Fate:	Would become bound to soils due to high viscosity. Slightly soluble in water. Bioaccumulation may occur.

1.4 PRELIMINARY DESIGNS

Based on existing data and an evaluation completed and included in the Revised CMS Report, which was submitted to U.S. EPA in January 2011, the following preliminary designs were developed for the targeted spot treatment programs in the three separate "source" areas:

Note: The following preliminary designs are provided to depict the areas of treatment and the conceptual treatment approach. However, the final approach will be modified as appropriate based on the results of the Bench-Scale and Pilot-Scale Treatability Study.

1.4.1 Main Plant Source Area

There is no unacceptable risk associated with the current groundwater plume, as there are no complete exposure pathways to on-site workers, there is an Environmental Restrictive Covenant (ERC) in place to prevent future ingestion of the impacted groundwater, the ERC states that the property is not to be used for residential purposes, and there are facility procedures that provide worker protection during performance of any subsurface excavation activities. Therefore, within the Main Plant Source Area, the goal of the corrective measures is to provide additional assurance that end-point criteria (EPC) will not be exceeded at point-of-compliance (POC) wells in the future by providing the outlined remedial response for the area depicted in Figure 4.

Injection Wells:	12 (pink)
Extraction Wells:	3 (blue)
Injected Chemical #1:	RegenOx™
Injection Events:	Event 1 – 28,000 pounds Event 2 – 28,000 pounds Event 3 – 28,000 pounds
Injected Chemical #2:	ORC Advanced®
Injection Event:	Event 4 – 7,700 pounds
Total Events:	4
Extraction Well:	During Injection Events
Treatment:	RegenOx™ – Every 4 weeks ORC Advanced® (ORC-A® – 4 weeks after Event 3 Recovered groundwater treatment at existing water treatment plant
Monitoring:	Nine Wells (1808, 1809, 1814, 1815, 1818, 1819, 1908, 2001 and 2002) Quarterly during active treatment for one year and annually for a maximum of an additional two years to monitor for rebound.

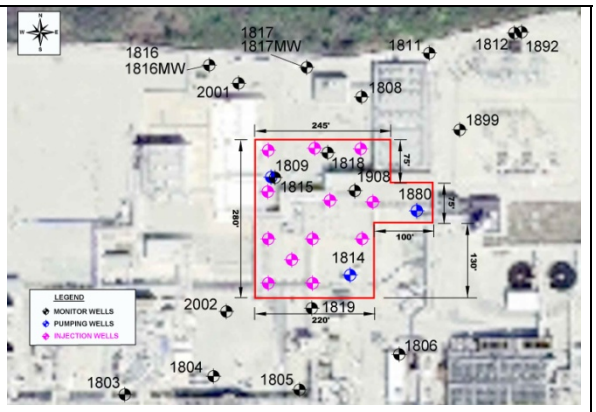

Figure 4 – Main Plant Source Area Preliminary Design

1.4.2 1831 Floodplain Source Area

There is no unacceptable risk associated with the current groundwater plume, as there are no complete exposure pathways to on-site workers, there is an ERC in place to prevent future ingestion of the impacted groundwater, the ERC states that the property is not to be used for residential purposes, and there are facility procedures that provide worker protection during performance of any subsurface excavation activities. Therefore, the goal of the corrective measures in this localized area is to reduce contaminant mass to a degree such that it can be shown that POC EPC will not be exceeded in down-gradient POC wells in the future by providing the outlined remedial response for the area depicted in Figure 5.

Injection Points:	14
Injected Chemical:	RegenOx™ (Part A) / ORC-A®
Injection Event:	1,000 / 2,200 pounds
Total Events:	1
Monitoring:	Seven wells (1822, 1831, 1833, 1870, 1872, 1876, and a new well) Semi-annually for one year and annually for a maximum of an additional two years to monitor for rebound.

Figure 5 – 1831 Floodplain Source Area Preliminary Design

1.4.3 1855 Source Area

There is no unacceptable risk associated with the current groundwater plume, as there are no complete exposure pathways to on-site workers, there is an ERC in place to prevent future ingestion of the impacted groundwater, the ERC states that the property is not to be used for residential purposes, and there are facility procedures that provide worker protection during performance of any subsurface excavation activities. Therefore, the goal of the corrective measure in this area is to reduce pCBT concentrations up-gradient of POC monitor well 1855 and to reduce the pCBT concentration within POC monitor well 1855 to a concentration below the pCBT EPC by providing the outlined remedial response for the area depicted in Figure 6.

Injection Points:	36
Injected Chemical:	RegenOx™ (Part A) / ORC-A®
Injection Event:	675 pounds / 1,350 pounds
Total Events:	1
Monitoring:	Seven wells (1837, 1855, 2010, 2011, 2012, 2013, and 2014) Semi-annually during treatment for one year and annually for a maximum of an additional two years to monitor for rebound.

Figure 6 – 1855 Source Area Preliminary Design

1.5 OBJECTIVE

The objectives of the Bench-Scale and Pilot-Scale Treatability Study include:

- Determine the ability of various chemical oxidants to successfully treat COCs present in saturated Site soils and groundwater.
- Determine if treatment by various chemical oxidants will create undesirable side products or mobilize metals.
- Select an effective chemical oxidant and identify the dosages necessary to accomplish the overall remedial objective.
- Assess the benefit of a bioenhancement injection program within the three source areas.

Additionally, a supplemental soil characterization of the 1855 Source Area is recommended to be conducted concurrent with field activities associated with the Bench-Scale Treatability Study. This supplemental soil characterization will provide additional information to be used in the final remedial design for the 1855 Source Area.

2.0 SUPPLEMENTAL SOIL CHARACTERIZATION

In 1999, piping, tanks, and equipment associated with the production of Treflan were included within a demolition project. This demolition project included the T60 area, including the former pCBT aboveground storage tank (AST). As part of the on-going groundwater monitoring program, a gradual increase in the pCBT concentration in Unit I POC monitor well 1855 was observed between 2005 and 2010, with recent concentrations decreasing to below the POC EPC. In late 2009, the following activities were performed to locate the source of the increasing pCBT concentrations at monitor well 1855:

- Review of aerial photographs identified soil piles located hydraulically up-gradient of monitor well 1855 dating back to approximately 2005. Analytical laboratory results of soil samples collected from 10 random locations within the soil piles reported below laboratory detection limits for pCBT. These results confirm that the dissolved-phase pCBT groundwater concentrations were likely not derived from the soil piles.

- Review of historic aerial photographs identified a disturbed soil area in 1998. Further research confirmed that this area was associated with fill material utilized to fill a low spot north of monitor well 1837. Analytical laboratory results of soil samples collected from eight random locations within this soil fill area reported below laboratory detection limits for pCBT. These results confirm that the dissolved-phase pCBT groundwater concentrations were likely not derived from the soil fill area.

- Five new groundwater monitor wells were installed hydraulically up-gradient of monitor well 1855 to further assess this area. Groundwater analytical laboratory results confirmed the presence of elevated pCBT concentrations hydraulically up-gradient of monitor well 1855. The pCBT concentrations were higher in the samples collected closer to the T60 area, and decreased by more than one order of magnitude in the groundwater sample collected hydraulically up-gradient (northeast) of the T-60 area.

Based on the soil and groundwater analytical laboratory results (i.e., monitor wells 1837, 1855, 1836, 1856, 2010, 2011, 2012, 2013, and 2014), it appears that the former T60 area is likely the source of the southwestern pCBT plume.

Prior to design of the final remedy and implementation of the remedial response, it is critical to adequately define the source area and ensure that the area projected for treatment will not become impacted in the future by migration of pCBT from an untreated hydraulically up-gradient source area.

2.1 SITE INVESTIGATION ACTIVITIES

A total of seven soil borings will be installed to obtain additional information regarding the likely pCBT source area and to assess whether soils within this area have the potential to continue to provide a pCBT source to the Unit I groundwater system. Figure 7 presents proposed investigation locations relative to historic site features and the Q4-2009 pCBT plume.

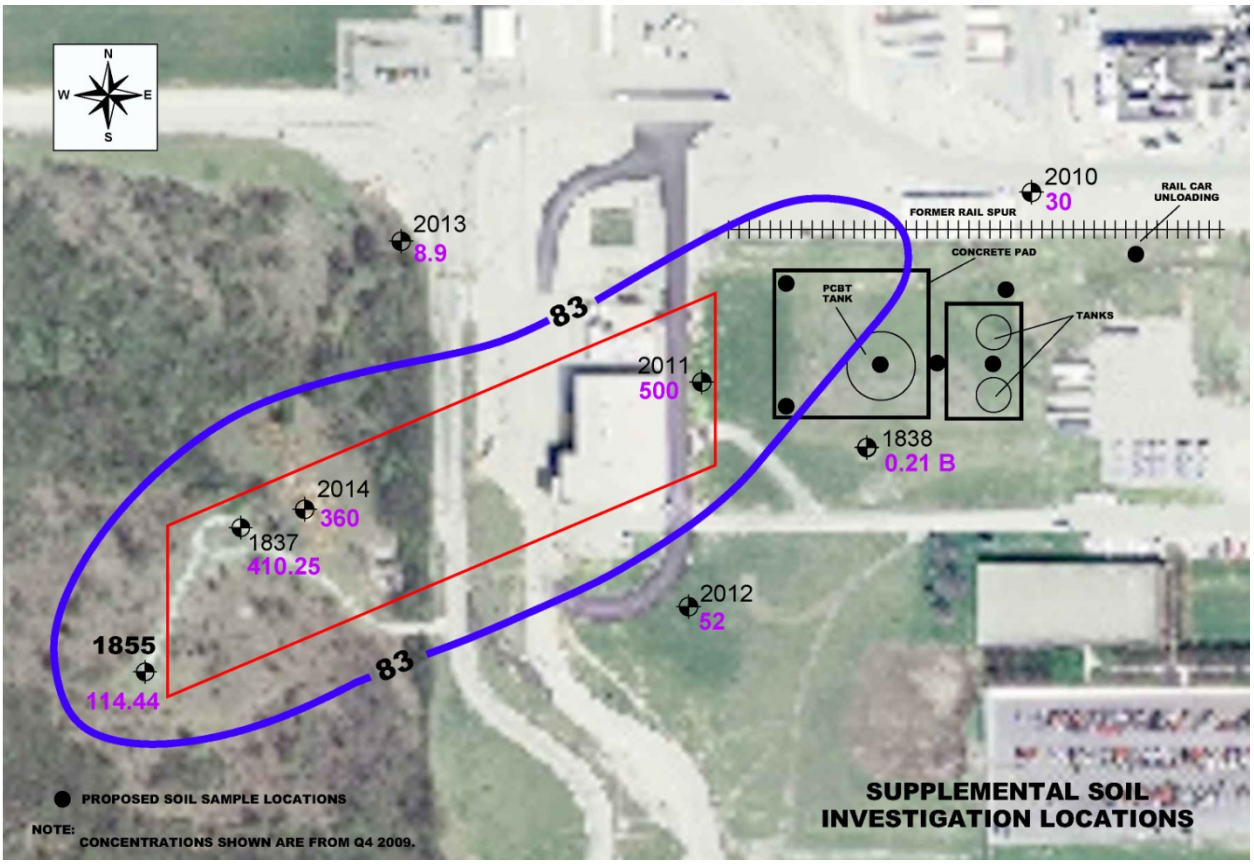

Figure 7 – 1855 Source Area Supplemental Soil Investigation Locations

2.1.1 Investigation Location and Utility Clearance

Prior to initiation of subsurface field activities, a site reconnaissance will be completed to stake and clear the proposed investigation locations. After location staking, Evonik will be contacted to identify subsurface utilities located in the investigation area.

2.1.2 Soil Boring Installation

Soil borings will be advanced with a truck-mounted, hollow-stem auger drilling rig with 4-inch inside diameter augers, or a sonic rig. Soil samples will be collected continuously from the ground surface to the base of Unit I, estimated to be 70 feet bgs.

Some of the soil borings are proposed to be advanced through the synthetic "capped" area; therefore, prior to piercing the cap, a portion of the cap will be removed and upon completion of investigation activities, the removed cap material will be replaced to maintain the integrity of the cap.

Once the soil samples are aboveground, soils will be described according to the Unified Soil Classification System (USCS), equivalent to ASTM D2488. In addition, a portion of each soil sample will be placed into individual Ziploc bags and the headspace gas will be monitored with a photo-ionization detector (PID). This field screening technique, along with visual and olfactory observations of the soil, will be utilized to select soil samples for chemical analyses. It is anticipated that a maximum of four soil samples will be collected from each soil boring (three from depths indicating the highest potential to contain pCBT concentrations in the vadose zone, and one soil sample from within the saturated zone immediately above the base of the Unit I water-bearing unit). Documented observations of the soil samples will consist of sample depth, lithology, color, structure, staining, degree of sample saturation, and the presence or absence of odors. An Indiana-Licensed Professional Geologist (LPG) will sign off on the geologic boring logs.

After completing soil sample collection, the inner rod of the augers will be removed and the soil boring will be plugged and abandoned concurrent with auger removal. Plugging and abandonment of the soil borings will be performed in accordance with Indiana regulations. After reaching ground surface, the "cap" material will be replaced, soil cover will be placed over the "cap" material, and the area will be re-vegetated.

2.1.3 Analytical Laboratory Testing

Soil samples will be placed into laboratory provided sample containers and labeled with the following information: location, identification (ID) number, container number, depth (soil), date, time, and sampling personnel. This information will also be entered on a chain-of-custody form. Soil samples will be placed into a cooler and chilled to a temperature of approximately 4^{o}C for shipment to Heritage Environmental Services, LLC laboratory in Indianapolis, Indiana for analysis of VOCs by U.S. EPA Test Method 8260 and semi-volatile organic compounds (SVOCs) by U.S. EPA Test Method 8270.

2.1.4 Decontamination and Field Derived Waste

Drilling and sampling equipment will be decontaminated prior to the initiation of subsurface investigation activities. To ensure proper decontamination, soil samplers will be scrubbed with a non-phosphate detergent and distilled water wash, rinsed again with distilled water, and then allowed to air dry before being reused.

3.0 BENCH-SCALE TREATABILITY STUDY

Prior to implementation of a Pilot-Scale Treatability Study or full-scale implementation of a remedial approach, it is beneficial to perform a Bench-Scale Treatability Study to confirm that the primary COCs can be effectively treated by oxidative treatments. The results of the Bench-Scale Treatability Study will then be validated through implementation of an on-Site Pilot-Scale Treatability Study.

3.1 INTRODUCTION

A Bench-Scale Treatability Study assesses the treatability of the COCs, defines potential chemical reactions (adverse or desired) when the reaction occurs, and allows estimation of degradation rates. It is likely that the Bench-Scale Treatability Study will overestimate both the contaminant and oxidant degradation rates due to mixing and continuous contact in a closed system. However, rates obtained in the laboratory will provide useful information about relative COC degradation rates and the relative longevity of the oxidant that can be used in the Pilot-Scale Treatability Study.

Components of the bench-scale reactor should include the aquifer material (soil and water) since it will contain the majority of the contaminant(s) and other parameters that will largely influence oxidant demand and the success or failure of the treatment process.

3.1.1 Main Plant Source Area

As the first step in the Bench-Scale Treatability Study Testing program, soil samples will be collected through the utilization of a hollow-stem auger or sonic drill rig from two locations within the Main Plant Source Area. One location will be located north of monitor well 1814 and the second location will be located southeast of monitor well 1815 (see orange locations presented on Figure 8). Soil boring logs for 1814 and 1815 are provided in Attachment 1. In addition to the 5-foot soil samples collected from each soil boring with a continuous split spoon sampler, as shown in the following data summary, a groundwater sample will be collected from the two new locations after well completion.

Well ID	Screened Interval (ft. bgs)	DTW (ft. bgs)	Saturated Soil Type	Proposed Soil Sample Interval
1814	55 – 67	61	Fine Sand with Gravel	62 – 67
1815	66 – 96	64	Gravelly Sand	65 - 70

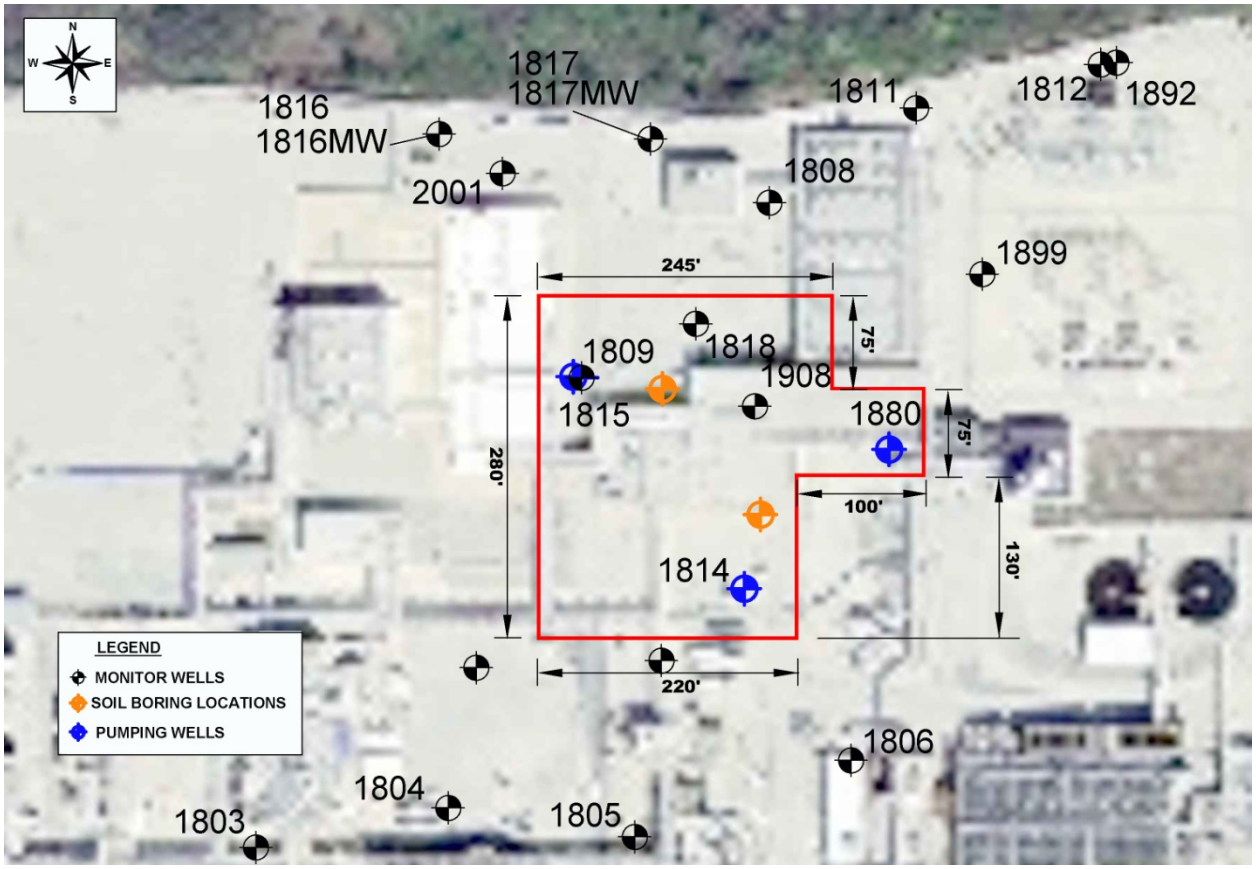

Figure 8 – Main Plant Source Area Bench-Scale Sample Locations

3.1.2 1855 Source Area

As the first step in the Bench-Scale Treatability Study testing program, soil samples will be collected through the utilization of a hollow-stem auger drill rig from five locations in the 1855 source area. Three of these locations will be at the up-gradient edge of the 1855 treatment area (see orange locations presented on Figure 9) and will be utilized as injection points during the Pilot-Scale Treatability Study. The other two locations (NMW-1 and NMW-2) will be

approximately 30 feet and 60 feet down-gradient from the three pilot injection wells, and will be utilized as monitoring points during the Pilot-Scale Treatability Study. The soil samples from the five boring locations may be composited in the laboratory if the volume of soil collected is not adequate to run multiple bench-scale tests. In addition to the 2-foot soil samples collected from each soil boring with a continuous split spoon sampler, as shown in the following data summary, a groundwater sample will be collected from the five new locations after well completion.

Well ID	Screened Interval (ft. bgs)	DTW (ft. bgs)	Saturated Soil Type	Proposed Soil Sample Interval
2011	63 – 68	65	Sand and Gravel	68 – 70

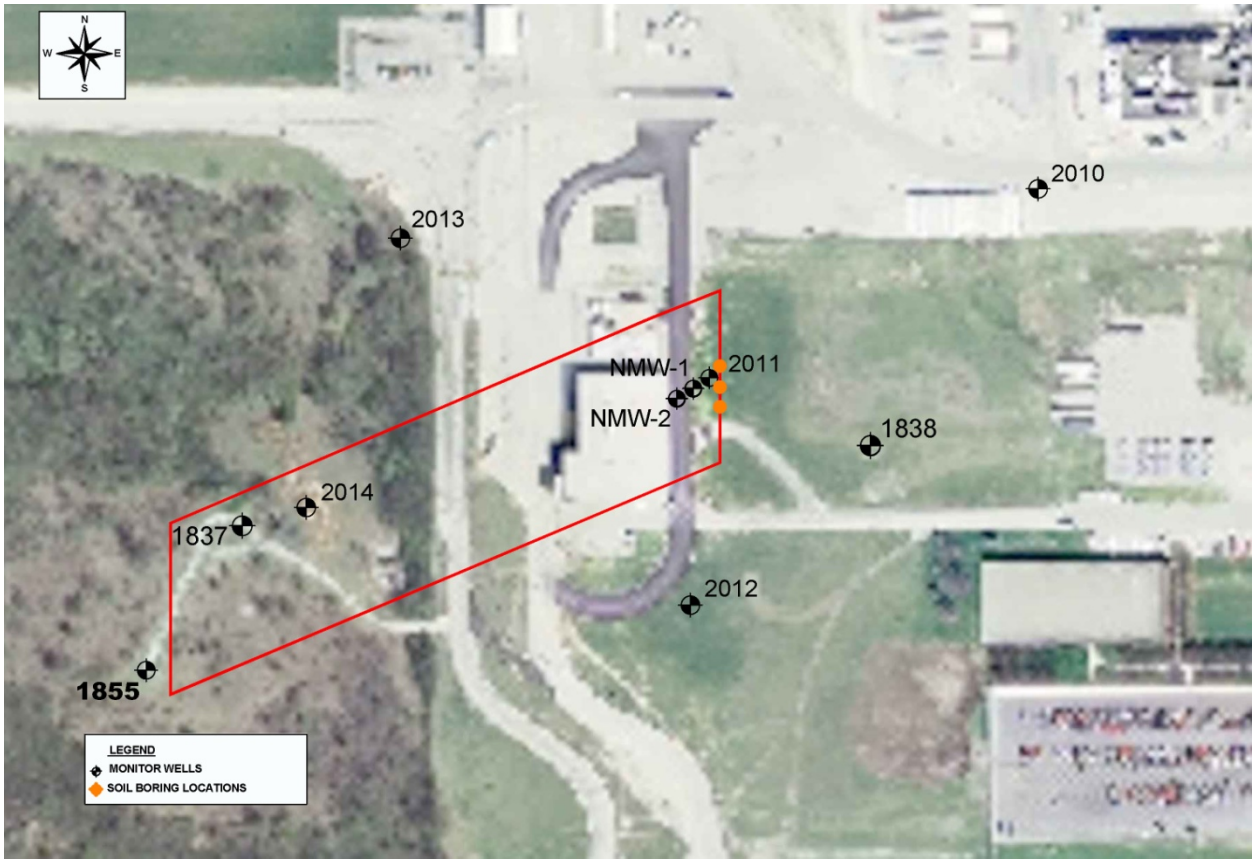

Figure 9 – 1855 Source Area Bench-Scale Sample Locations

3.1.3 1831 Floodplain Source Area

As the first step in the Bench-Scale Treatability Study testing program, soil samples will be collected through the utilization of a hollow-stem auger drill rig or direct-push rig from one location in close proximity to monitor well 1831 (see Figure 10). The soil boring log for monitor well 1831 is provided in Attachment 1. In addition to the three 5-foot soil samples collected from the soil boring as shown in the following data summary, a groundwater sample will be collected from monitor well 1831.

Well ID	Screened Interval (ft. bgs)	DTW (ft. bgs)	Saturated Soil Type	Proposed Soil Sample Interval
1831	23 – 28	8.75	Clayey Sand	9 – 14
			Silty Clay	16 – 21
			Silty Sand	24 – 29

Figure 10 – 1831 Floodplain Source Area Bench-Scale Sample Locations

3.2 SAMPLE COLLECTION PROCEDURES

3.2.1 Soil Sample Collection Procedures

3.2.1.1 Investigation Location and Utility Clearance

Prior to initiation of subsurface field activities, a site reconnaissance will be completed to stake and clear the proposed investigation locations. After location staking, Evonik will be contacted to identify subsurface utilities located in investigation area and requested to provide additional support, as required.

3.2.1.2 Soil Boring and Well Installation

Soil borings will be advanced with a truck-mounted, hollow-stem auger drilling rig with 4-inch inside diameter augers, a sonic rig, or a direct-push rig (within the floodplain area). Once the soil samples from the identified intervals are aboveground, approximately five kilograms of soils will be sealed into individual air-tight baggies. Each soil-containing baggie will be labeled with the following information: location, ID number, container number, depth (soil), date, time, and sampling personnel. This information will also be entered on a chain-of-custody form. Soil samples will be placed into a cooler and chilled to a temperature of approximately 4^{o}C for shipment to a laboratory for performance of bench-scale testing.

For borings advanced with the hollow-stem auger drilling rig, the inner rod of the augers will be removed after reaching the soil boring target depth and well completion procedures will commence. Future injection and monitor wells will be constructed by installing screen across the entire Unit I saturated interval, based on historic data and field observations. Wells will be completed with 0.040-inch slotted, 2-inch diameter, Schedule 40, flush threaded polyvinyl chloride (PVC) screen; and 2-inch diameter, Schedule 40, flush threaded PVC casing to extend the well to ground surface.

Upon completion of well casing and screen installation, filter pack will be placed within the annular space between the injection/monitor well casing and screen and the hollow-stem augers to a height of approximately two feet above the screened interval. Concurrent with filter pack installation, the augers will be removed. This completion procedure will ensure that filter pack will be appropriately placed in the well completion. Thereafter, approximately two feet of granular bentonite will be installed above the filter pack and a cement/bentonite grout will be installed from the bentonite seal to the base of the locking-cap assembly. The well will then be completed within flush-mounted well completions, slightly elevated from the surrounding paved surfaces.

The following information will be entered into the well construction log:

- Project name;
- Project location;
- Drilling subcontractor;
- Field representative;
- Well identification;
- Date installed;
- Completion materials and corresponding depths (bgs);
- Top-of-casing and ground level elevations; and,
- Surface completion.

After the cement and concrete are allowed to cure for approximately 24 hours, well development activities will commence. Development activities will continue until developed water is relatively free of suspended sediment and field pH, specific conductance, and temperature measurements are equilibrated. Upon well completion, an Indiana-licensed public land surveyor will be retained to survey well coordinates and top-of-casing elevation for the newly installed wells.

For the boring advanced with a direct-push drilling rig in the Floodplain, after completing soil sample collection, the soil boring will be plugged and abandoned. Plugging and abandonment of the soil boring will be performed in accordance with Indiana regulations.

3.2.1.3 Soil Analytical Laboratory Testing

In addition to the soil samples retained for the Bench-Scale Treatability Study, a portion of soil from each sample interval will be placed into laboratory provided sample containers and labeled with the following information: location, ID number, container number, depth (soil), date, time, and sampling personnel. This information will also be entered on a chain-of-custody form. Soil samples will be placed into a cooler and chilled to a temperature of approximately 4^{o}C for shipment to a Heritage Environmental Services, LLC laboratory in Indianapolis, Indiana for analysis of VOCs by U.S. EPA Test Method 8260, SVOCs by U.S. EPA Test Method 8270, Total RCRA Metals (metals) by U.S. EPA Test Method 6010/7000, and total organic carbon (TOC) by U.S. EPA Test Method 9060.

3.2.1.4 Decontamination and Field Derived Waste

Drilling and sampling equipment will be decontaminated prior to the initiation of subsurface investigation activities. To ensure proper decontamination, soil samplers will be scrubbed with a non-phosphate detergent and distilled water wash, rinsed again with distilled water, and then allowed to air dry before being reused.

3.2.2 Groundwater Sample Collection Procedures

Groundwater samples will be collected in accordance with the Groundwater Quality Assurance Project Plan (QAPP) Revision 3, dated May 2010. Approximately 12 liters of water will be collected from the two newly installed wells in the Main Plant Source Area, and the five newly installed wells in the 1855 Source Area. Samples should be placed into individual 1-liter containers supplied by the laboratory that have a septum seal on the top. Sample containers should be filled to the top with a meniscus bulge to prevent the potential accumulation of air in the jar and volatilization of contaminants during transport. Note that since there are three soil sample intervals within the 1831 Floodplain Source Area, there would need to be a total of 36 liters of water collected from monitor well 1831, which will be forward for bench-scale testing.

In addition to the groundwater samples retained for the Bench-Scale Treatability Study, split groundwater samples will be placed into laboratory provided sample containers and labeled with the following information: location, ID number, container number, date, time, and sampling personnel. This information will also be entered on a chain-of-custody form. At the end of the

sampling efforts, the split sample and the chain-of-custody form will be transported to Heritage Environmental Services, LLC laboratory in Indianapolis, Indiana for analysis of VOCs by U.S. EPA Test Method 8260, SVOCs by U.S. EPA Test Method 8270, and Total RCRA Metals (metals) by U.S. EPA Test Method 6010/7000.

3.3 OXIDANT IDENTIFICATION

Information contained within the referenced documents was used to identify the following oxidants that would be applicable to Site COC treatment [U.S. EPA, Huling and Pivetz; Regenisis, and U.S. Air Force (USAF)]:

Permanganate

Contaminant oxidation by MnO_4^- occurs by electron transfer rather than through the rapid H_2O_2 reaction and radical attack characteristic of Fenton oxidation. Presented below is a summary of advantages and disadvantages:

Advantages:

- Relatively slow reaction rate of MnO_4^- in subsurface systems, allowing for greater transport distances of MnO_4^- during injection delivery in medium and high permeability materials.
- MnO_4^- generally persists in the subsurface for months; however, persistence varies based on the concentration and volume of oxidant injected and from site to site.
- The long-term persistence of MnO_4^- contributes to diffusive transport of the oxidant into low-permeability materials, such as silty clay.
- Sodium permanganate ($NaMnO_4$) is highly soluble (40%; 400 g/L), produced and delivered as a solution, and only requires dilution (if desired) before injection. Therefore, precipitation of $NaMnO_4$ is not possible.

Disadvantages:

- A wide range of naturally occurring reactants other than the target contaminant(s) also react with MnO_4^- and impose a background oxidant demand. The background oxidant demand reduces oxidation efficiency and is generally greater than the demand imposed by the target COCs, which may increase the cost.
- The accumulation of manganese dioxide [MnO_2(solid)] at the NAPL interface may interfere with mass transfer, and excessive accumulation in porous media may result in permeability reduction.
- The solubility of potassium permanganate ($KMnO_4$) is temperature-sensitive. Typical injection concentrations [2 to 3 grams per liter (g/L)] are well below the solubility (6.5 g/L @ 20 ˚C). However, differences in temperature between the $KMnO_4$ solution in the mixing tank and in the aquifer could result in precipitation of $KMnO_4$ in the aquifer where it is cooler. Accumulation of un-dissolved $KMnO_4$ particles in the well, in the sand and gravel pack around the well, and in the formation near the well, can cause loss in permeability.
- In subsurface systems involving significant reaction between MnO_4^- and high concentrations of organic chemicals, large quantities of carbon dioxide (CO_2) gas can be produced in the aquifer, resulting in CO_2 entrapment, and can cause permeability and hydraulic conductivity reductions in the aquifer.
- Hydraulic short circuiting and/or preferential pathways may result in the delivery of the oxidant into non-target zones.
- U.S. EPA has established a secondary maximum contaminant level for drinking water for manganese [0.05 milligrams per liter (mg/L)] based on color, staining, and taste.
- Permanganate will not react with benzene, one of the primary Site COCs.

Persulfate

Persulfate salts dissociate in aqueous solutions to form the persulfate anion $S_2O_8^{2-}$, which is a strong oxidant that can degrade many environmental contaminants. $S_2O_8^{2-}$ can also be catalyzed with various reactants to form the sulfate radical (SO_4^-), a more powerful oxidant. Sodium persulfate ($Na_2S_2O_8$) is the most common and feasible form used in ISCO.

Advantages:

- Persulfate is more stable in the subsurface than H_2O_2 and O_3, and the radical intermediate, SO_4^-, is more stable than the hydroxide ion (OH), suggesting fewer mass transfer and mass transport limitations.
- Persulfate will react with benzene, while permanganate does not, thus allowing this form of oxidant to be used in the remediation of fuel spills and benzene, toluene, ethylbenzene, and total xylenes (BTEX)-contaminated groundwater.
- Persulfate does not appear to react as readily with soil organic matter as permanganate.
- Low oxidant cost.
- High solubility.
- Persulfate can persist in the subsurface for weeks, suggesting that the natural oxidant demand for persulfate is low.
- Persulfate can be injected at high concentrations, can be transported in porous media, and will undergo density-driven and diffusive transport into low-permeability materials.

Disadvantages:

- Peer-reviewed literature is limited.
- Persulfate is less stable than permanganate and will not persist as long in subsurface systems.
- Catalysts are required in the persulfate reaction to produce the more powerful sulfate radical.
- There will likely be difficulties in achieving the optimal mix of reagents in the subsurface due to the lack of naturally occurring catalyst, and due to the difference in transport behavior of these reagents upon injection.
- Oxidant cost is higher than other oxidants, but may be offset by the lack of oxidant demand by non-target aquifer materials.

Hydrogen Peroxide/ Fentons

Fenton's reagent is a solution of hydrogen peroxide and an iron catalyst that is used to oxidize contaminants. Presented below is a summary of advantages and disadvantages (U.S. EPA, Huling and Pivetz):

Advantages:

- OH are a powerful non-specific oxidant that will react rapidly with many environmental contaminants.
- Reactions involving H_2O_2 are rapid, and it generally persists for <12 hours.
- Intermediate chemical species [O_2, perhydroxyl radical (HO_2)] may reductively transform contaminants. Fenton oxidation could address complex mixtures of organic compounds.
- Enhanced natural attenuation may be attributed to O_2 gas and heat. Oxidized inorganics may also serve as terminal electron acceptors.
- Low cost of H_2O_2.

Disadvantages:

- Excessive H_2O_2 decomposition via nonproductive reactions.
- Radical scavenging.
- Low reactive rate between some target contaminants and OH, O_2, HO_2.
- pH modification (acidification) is problematic in well buffered aquifers.
- Problematic delivery of H_2O_2 Fe(II), acid, and stabilizers due to reactive transport.
- Production of O_2 (gas) contributes to reductions in permeability. This may reduce the flow of groundwater and injected reagents through the targeted contaminant zones. It also results in sparging which contributes to volatilization and redistribution of contaminants.
- Pneumatic transport of volatiles, NAPL, and contaminated groundwater away from the injection point; heavy asphalt, excessive pressure.
- Incomplete oxidation and mobilization of metals.
- Excessive release of heat and elevated temperatures associated with high H_2O_2 concentrations may damage/melt PVC/plastic wells.
- Unproven use of stabilizer reagents.
- Health and safety issues regarding release of volatiles, steam, and strong oxidant solutions.

Calcium Peroxide/ Fentons (USAF)

This process uses calcium peroxide (CaO_2) powder as a source of H_2O_2 to promote modified Fenton chemistry, which slowly decomposes to release oxygen at a "controlled" rate.

Advantages:

- Imparts the alkalinity and peroxide needed to activate the persulfate.
- When mixed with water it provides a long-term slow release source of hydrogen peroxide and calcium hydroxide. The hydrogen peroxide that is slowly formed decomposes to oxygen and water, providing an extended oxygen source for subsequent bioremediation of petroleum hydrocarbons (taking up to several weeks to attenuate).
- The resultant calcium hydroxide (hydrated lime) that is produced serves several purposes:
    - It increases the total dissolved ion concentration, which makes the solution less likely to leach metals from the soil into the groundwater.
    - The calcium from the hydrated lime will precipitate the sulfate that is produced during the consumption of the persulfate.
- Works well with chlorinated VOCs, including chlorobenzene.
- Among the safest to handle of peroxide compounds. It represents no significant hazards with regards to skin contact, inhalation, or ingestion.

Disadvantages:

- The calcium sulfate (gypsum) precipitation helps to reduce sulfate groundwater concentrations, which may impact the secondary drinking water standard of 250 parts per million (ppm).
- It is vigorous and exothermic and can lead to VOC, oxygen (O_2) and peroxide gas evolution;
- If high concentrations of contaminants are encountered frothing and day lighting can occur;
- Significantly higher cost that other products.
- Calcium peroxide does not dissolve in water; therefore, this product can be difficult to disperse in the subsurface.
- The percentage of calcium peroxide is high for use as an activator.
- An oxidizer; therefore, contact with combustible materials (paper, cotton, organics, wood, leather, reducing agents, and other oxidizers) should be avoided.

Ozone

O_3 is a gas and a strong oxidant that is sparingly soluble in water and upon reaction does not leave a residual other than O_2. The solubility of O_3 is relatively low and is functionally dependent on temperature and the partial pressure of O_3 in the gas phase. Decomposition is much more rapid in the aqueous phase than in the gas phase due to the strong catalyzing reaction by the OH-.

Advantages:

- O_3 reacts with many, but not all important environmental contaminants.
- In-situ ozonation in the unsaturated zone is favorable relative to the saturated zone because: higher concentrations of O_3 can be injected, O_3 is more stable in gas than in water, diffusive transport is greater, and higher velocities (mass delivery rates) can be achieved.
- Co-injection and reaction of H_2O_2 and O_3 can yield OH, a strong, nonspecific oxidant.

Disadvantages:

- The instability of O_3 requires that it be generated on site and to be injected under pressure. Under this condition, hydraulic seals and other materials used in the remedial equipment must be compatible with ozone or they will rapidly deteriorate.
- O_3 has a short retention time in the subsurface because it reacts rapidly with a wide range of naturally occurring non-target chemical species (reduced minerals, organic matter, etc.), including OH-.
- O_3 has a relatively low solubility in water and is highly vulnerable to hydraulic short circuiting as a gas in the unsaturated zone.
- O_3 injected into the saturated zone is poorly/non-uniformly distributed and is transported very short distances.
- Specialized oxidant-resistant materials are likely to be required. Enhanced volatilization of contaminants may result from sparging the groundwater with O_3 (gas) and O_2 (gas).
- Since volatile organics and O_3 both represent a threat to human health, collection of volatile emissions (off-gases) using a vacuum extraction system may be required to minimize potential exposure pathways.
- O_3 does not react at an appreciable rate with some important environmental contaminants.

RegenOx™: RegenOx™ is a proprietary ISCO process using a solid oxidant complex (sodium percarbonate/catalytic formulation) and an activator complex (a composition of ferrous salt embedded in a micro-scale catalyst gel).

Advantages:

- RegenOx™ with its catalytic system has very high activity, capable of treating a very broad range of soil and groundwater contaminants including both petroleum hydrocarbons and chlorinated solvents.
- RegenOx™ has significant longevity in the subsurface allowing for both the initial contaminant degradation and the continued treatment of contaminants desorbing from the matrix.
- RegenOx™ is less immediately reactive, allowing for wider distribution.
- Unlike permanganate and persulfate, RegenOx™ does not add compounds that will potentially have an adverse impact on water quality and bioremediation. Secondary drinking water standards exist for sulfate and manganese, and the use of these chemicals to treat groundwater jeopardizes the quality of the water after treatment.
- When developing RegenOx™, a main objective was to employ an oxidant within the formulation that would not negatively interfere with bioremediation processes that would occur after the oxidation was complete. The RegenOx™ system leaves behind very little residue, limited primarily to the innocuous carbonate and bicarbonate ions. These residuals do not have a negative effect or interfere with efficient natural attenuation or enhanced bioremediation.
- With regard to shifting the geochemistry of the aquifer and the potential to increase the concentration of dissolved heavy metals, RegenOx™ generates basic conditions. Metals mobilization is less likely under basic conditions than acidic conditions. Furthermore, mobilized metals are typically stabilized by the geochemical conditions of the aquifer.

Disadvantages:

- Peer-reviewed literature is limited.
- More complex reaction chemistry than other oxidants, using both a solid oxidant complex and an activator complex.
- There will likely be difficulties in achieving the optimal mix of reagents in the subsurface.
- Oxidant cost is higher than other oxidants.

3.4 TESTING PROCEDURES

Capture and quantification of contaminant losses from the reactor is necessary to maintain a mass balance and to assess treatment performance. These losses include volatiles, displacement of aquifer material, and aqueous solutions. Recommended monitoring parameters that are a direct indicator of oxidative treatment include the target COCs, reaction byproducts, metals, and the oxidant.

3.4.1 Oxidants

Based on the information referenced and presented in Section 3.3, the following compounds will be evaluated during the Bench-Scale Treatability Study:

- Iron catalyzed sodium persulfate
- Calcium peroxide catalyzed sodium persulfate
- Iron catalyzed calcium peroxide
- RegenOx™

Testing

Once the samples are received at the bench-scale testing contractor, the following activities will be performed:

- Homogenize the soil by mixing gently, avoid vigorous mixing that may grind the particles, release VOCs, or alter the soil properties.
- Measure the pH of the soil mixture.
- From each of the test zones (as previously defined), 12 1-liter jars per sample interval will be prepared with a combination of soil and groundwater from the Site. Based on existing information, each jar is anticipated to be prepared with approximately 500 grams of soil and groundwater to fill the 1-liter jar. The 500 grams of soil to be placed into each of the 12 jars will be selected to be representative of the entire sampling interval, such that each 500-gram sample of soil will be similar to the other 500-gram samples (i.e., based on the percentage of sand, silt, clay, and gravel), based on visual observations of grain size and other soil properties observed in the laboratory. Preparation of the jars in this manner will allow the soil within each jar to be comparable to other jars and representative of field conditions.
- For each set of samples one test jar will be prepared and used as a control.

- The jars will be maintained in a dark environment at a temperature equivalent to the media's natural environment and allowed to equilibrate for 2 to 3 days.
- For each test, 50 milliliters (ml) of groundwater will be extracted from each jar prepared with soil from the same interval and replaced with 50 ml of 10% oxidant solution in each jar. The 10% oxidant solution was proposed based on experience with the proposed oxidants. Solutions with greater concentrations of oxidant tend to result in high reaction rates that cannot be safely handled in the laboratory, and solutions with lower concentrations of oxidant result in lower reaction rates that can be difficult to measure in the laboratory, or that are difficult to distinguish from other mechanisms, such as desorption.
- For the control samples, 50 ml of groundwater will be extracted from the jars prepared with soil from the same interval and replaced with 50 ml of groundwater. Historically, some volatilization or some desorption from the soil will cause the post-treatment sample results to be somewhat lower or higher than the pre-treatment sample. This change is assumed to be a function of the testing process and a correction is applied to all of the treatment samples.
- The extracted water from each jar will be managed as follows:
    - Extracted water from each of the containers will be combined and placed into analyte specific laboratory provided sample containers.
    - Containers will be forwarded to Heritage Environmental Services, LLC laboratory in Indianapolis, Indiana for analysis of:
        - Main Plant Source Area - VOCs by U.S. EPA Test Method 8260, SVOCs by U.S. EPA Test Method 8270 (Low Level), and metals by U.S. EPA Test Method 6010/7000/7000.
        - 1855 Source Area – VOCs by U.S. EPA Test Method 8260, SVOCs by U.S. EPA Test Method 8270 (Low Level), and metals by U.S. EPA Test Method 6010/7000/7000.
        - 1831 Floodplain Source Area - VOCs by U.S. EPA Test Method 8260, SVOCs by U.S. EPA Test Method 8270 (Low Level), and metals by U.S. EPA Test Method 6010/7000/7000.

      Note: Tentatively Identified Compound (TIC) analysis will be performed on VOCs and SVOCS, if the sample volume is adequate to perform this analysis. This analysis will be performed to identify potential breakdown products.
- Each test jar will be agitated for approximately 60 seconds and maintained under the following conditions:
    - Maintained at a temperature consistent with the media's natural environment;
    - Maintained in a dark setting; and,
    - Maintained in a sealed container.

  This material will then be allowed to remain in these conditions for a period of approximately 30 days to allow for the chemical oxidation process to reach its conclusion. At that point, the water will be extracted from the test vessels and submitted for analysis, as defined above.

- After completion of sample collection, the testing process will be continued to obtain additional bench-scale treatability testing data. However, the decision to submit additional samples for laboratory analysis will be based on the subsequent sample results. The goal is to allow the bench-scale treatability testing to proceed until completion of the chemical reaction.
- Concentrations associated with all three phases (solid, liquid, and vapor) will be measured both before the addition of the oxidant and after the test in completed. In addition, testing for COD, BOD, DO, CO_2, nitrates and sulfates will be performed at the conclusion of the bench-scale treatability testing to estimate the on-going biodegradation potential.
- A mass balance analysis will be conducted based on the measured concentrations prior to initiation of oxidant introduction and at the conclusion of oxidant testing.

In addition to the above bench-scale testing, a portion of the collected soil samples will be analyzed for total oxidant demand (TOD), which will be used to evaluate oxidant loading to be used during the Pilot-Scale Treatability Study.

3.5 BENCH-SCALE TREATABILITY STUDY RESULTS

After the Bench-Scale Treatability Study is completed, the results will be summarized in a technical memorandum and submitted to U.S. EPA. The results of the Bench-Scale Treatability Study will be utilized in designing the following specific aspects of the Pilot-Scale Treatability Study for each source area:

- Selection of one specific chemical oxidant for the pilot-scale study, using a model that incorporates the following criteria to evaluate the bench-scale results:
    - Reduction of primary COC concentrations;
    - Potential for negative effects (e.g., metals mobilization, daughter product generation);
    - Impact of oxidant on future treatment, such as bioenhancement and MNA; and,
    - Oxidant costs.
- Identification of the chemical oxidant injection dosage (concentration, rate, and volume).
- The potential for metals mobilization.

- The bioenhancement chemical and its proposed pilot-scale dosage, which will be refined based on the bench-scale testing results. Design factors to be considered in selection and dosing of the bioenhancement chemical include:
    - Effectiveness in reducing primary COC concentrations based on a literature search and relevant experience;
    - Anticipated COC concentrations remaining after the ISCO phase of Pilot-Scale Test, based on Bench-Scale results;
    - Experience with various ISCO/bioenhancement chemical combinations (compatibility);
    - Impact of selected oxidant on bioenhancement and MNA; and,
    - Bioenhancement chemical costs.

4.0 PILOT-SCALE TREATABILITY STUDY

Upon completing the Bench-Scale Treatability Study and prior to full-scale implementation, a Pilot-Scale Treatability Study will be performed. The Pilot-Scale Treatability Study will include both the chemical oxidant selected following the Bench-Scale Treatability Study and a bioenhancement chemical. Any recommended modifications to the proposed Pilot-Scale Treatability Study presented below, based on the results of the Bench-Scale Treatability Study, will be included within the technical memorandum for the Bench-Scale Treatability Study. Also, a brief letter report will be submitted following the ISCO phase of the Pilot-Scale Test but before the bioenhancement phase of the Pilot-Scale Test in order to incorporate information learned during the ISCO phase into the bioenhancement phase.

The objectives of the Pilot-Scale Treatability Study are to determine COC destruction efficiency, the timeframe for treatment, density of application and resultant treatment zone size, and the viability of the ISCO/enhanced bioremediation approach to achieve the treatment goal of providing additional assurance that EPC will not be exceeded at POC wells in the future.

COC destruction efficiency will be evaluated as a measure of how well the treatment area is able to effectively remove primary COC concentrations from the aqueous phase. In addition, concentration vs. time plots (combined with the concentration vs. distance plots) will help develop treatment timeframes.

4.1 PILOT-SCALE PROGRAM

The Pilot-Scale Treatability Study will focus on a portion of the source area, which is located hydraulically up-gradient of the center of the source area, thereby minimizing the potential that the treated area will become impaired after completion of the Pilot-Scale Treatability Study and prior to full-scale implementation. Presented below are the areas proposed for each of the three source areas.

4.1.1 Main Plant Source Area

The Pilot-Scale Treatability Study for this source area will consist of the injection of the selected chemical oxidant into three injection wells shown in green on Figure 11 (one located east of 1818, one located southeast of 1908, and one located between 1908 and 1814) and operation of one groundwater extraction well (1880) shown in blue on Figure 11.

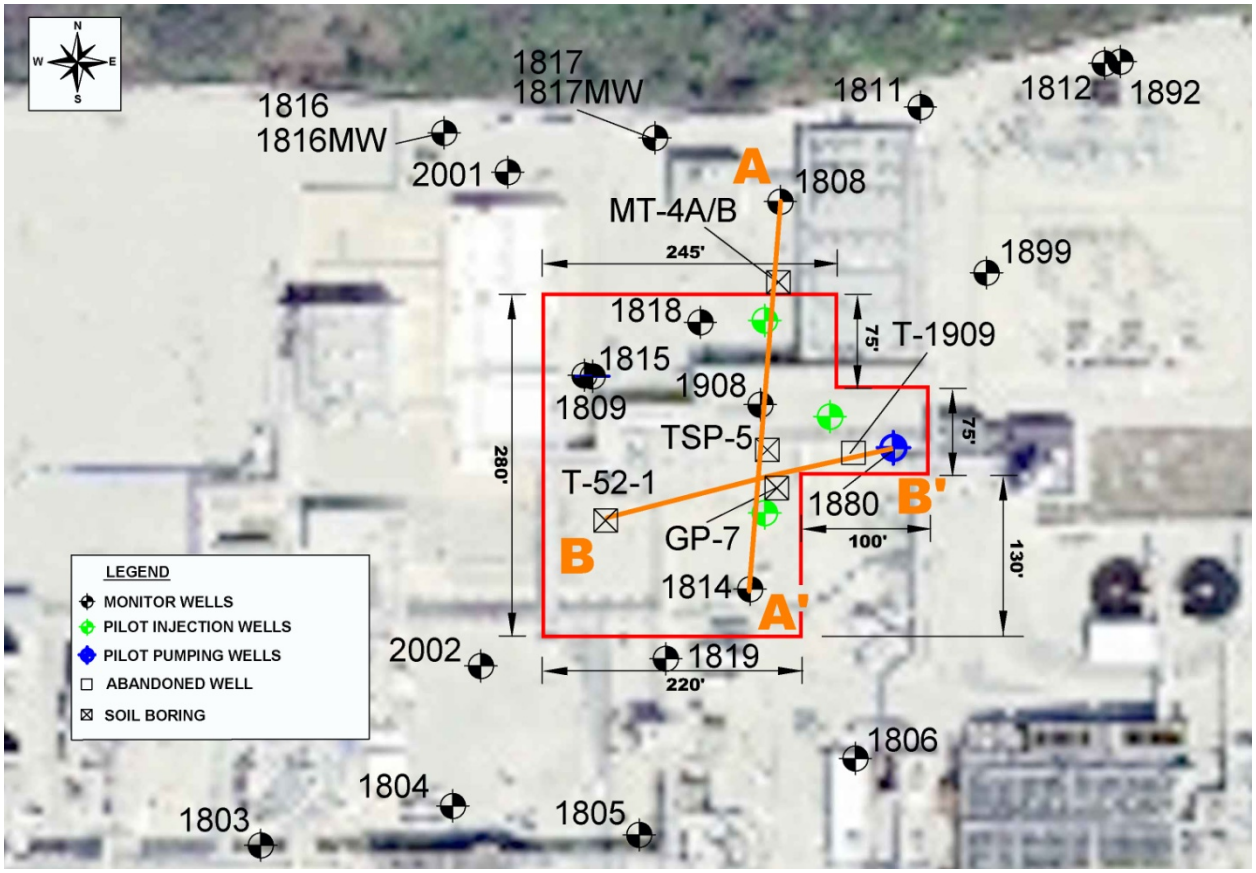

Figure 11 – Main Plant Source Area Pilot-Scale Locations

Bioenhancement chemical injection will utilize the same three pilot injection wells, and will be scheduled approximately twelve weeks following the completion of chemical oxidant injection. Groundwater extraction well 1880 will be operated during and following the bioenhancement chemical injection for the same length of time as it operates following the chemical oxidant injection pilot program (i.e., anticipating similar travel times for distribution).

Performance monitoring during the Pilot-Scale Treatability Study will include monitor wells 1818, 1908, 1814, 1808, and 1880 (after operation of this well ceases). Data gathered during performance of this monitoring will be used to confirm the quantity of bioenhancement chemical to be injected, which will be provided in the brief letter report.

Table 1 provides information regarding distance from the pilot injection wells and estimated travel times of oxidant solution to the five monitor wells. These estimations of groundwater travel times use simplified groundwater flow assumptions (see Attachment 2). A volumetric calculation was made to calculate the chemical radius of influence during injection, and then non-pumping flow was estimated using the Darcy flow equation:

$v = K*i/n$, where

v = seepage velocity

K = hydraulic conductivity

I = hydraulic gradient

n = porosity

The effect of pumping from well 1880 at a rate of one gallon per minute was estimated using Neuman type curve analysis.

Since the treatment area is located across the Unit I groundwater divide, and pumping well 1880 will be turned on five days prior to the start of the injection events, it is anticipated that injected fluid will reach each of the five monitor wells.

Table 1 – Travel Times to Monitor Wells, Main Plant Source Area

Monitor Well	Distance From Nearest Injection Point To Monitor Well, Feet	Travel Time To Monitor Well, Days
1880 (pumping)	50	1.7
1908	50	19
1818	50	19
1814	65	25
1808	100	39

Assumptions:

- Hydraulic Conductivity = 0.06 ft/min (Harza, 1989. *Phase E Site Assessment Report*)
- Porosity = 0.30 (Fetter, 1988. *Applied Hydrogeology)*
- Specific Yield of Aquifer = 0.25 (Fetter, 1988. *Applied Hydrogeology)*
- Saturated Thickness = 18 feet (CMS Report conceptual design)
- Volume Injected = 2,800 gallons (including 50 gallon flush of clean water)
- Injection Rate = 5 gpm (CMS Report conceptual design)
- Chemical Radius of Influence at end of injection period = 4.7 feet (calculated)
- Static Hydraulic Gradient = 0.009 ft/ft (Based on Q2 2010 potentiometric map, CMS Report)
- 1880 Pumping Rate = 1 gpm
- 1880 Radius of Influence (at 5 days) = 216 feet (calculated)
- Used Neuman type curve analysis to account for pumping conditions.

4.1.2 1855 Source Area

The Pilot-Scale Treatability Study for this source area will consist of the injection of the selected chemical oxidant into three pilot injection wells installed during the sampling for the Bench-Scale Treatability Study and located along the central portion of the eastern most line of injection wells, east of 2011, shown in green on Figure 12.

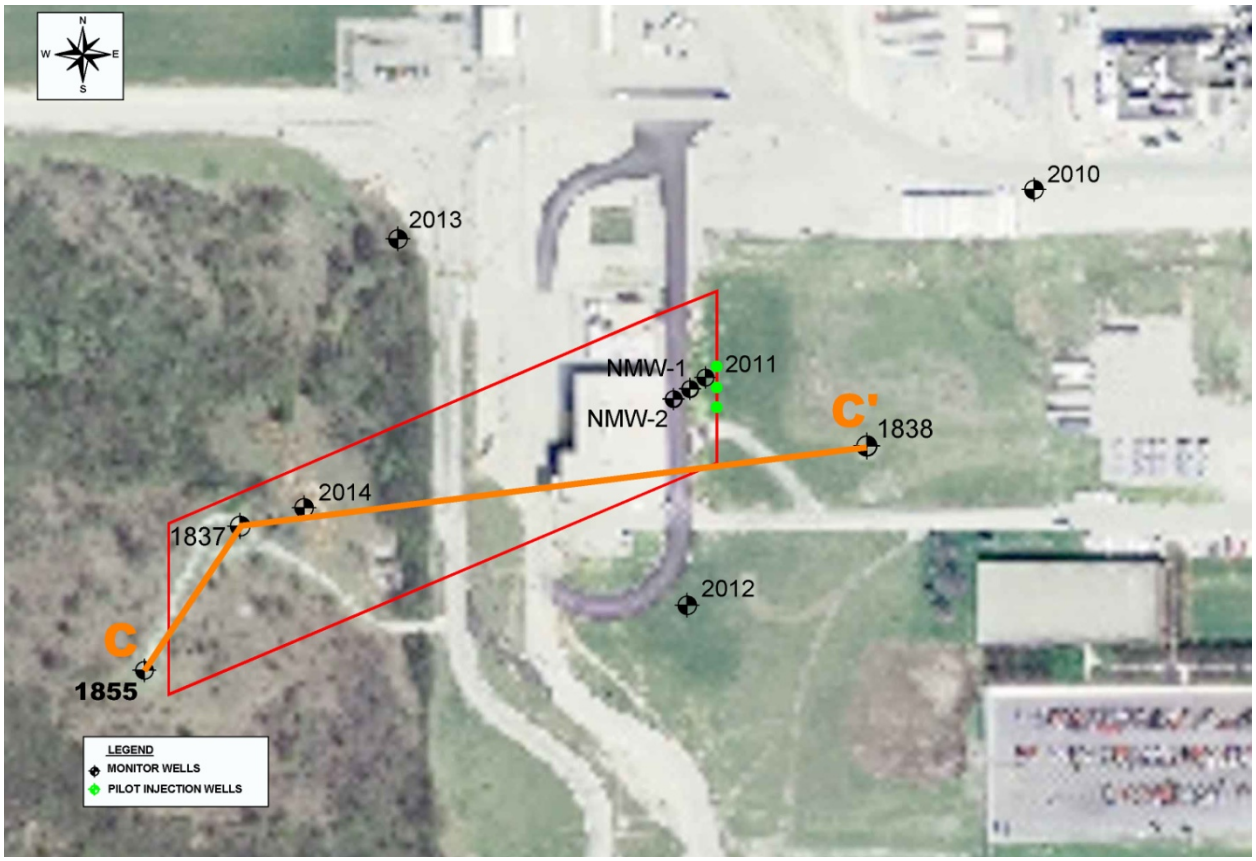

Figure 12 – 1855 Source Area Pilot-Scale Locations

Bioenhancement chemical injection will utilize the same three pilot injection wells, and will be scheduled approximately twelve weeks following the completion of chemical oxidant injection.

Performance monitoring will include monitor well 2011, and two new monitor wells, located approximately 30 feet (NMW-1) and 60 feet (NMW-2) down-gradient of the pilot injection wells, as shown on Figure 12. Data gathered during performance of this monitoring will be used to confirm the quantity of bioenhancement chemical to be injected, which will be provided in the brief letter report.

Table 2 provides information regarding distance from the pilot injection wells and estimated travel times of oxidant solution to the three monitor wells. These estimations of groundwater travel time use simplified groundwater flow assumptions (see Attachment 2). A volumetric

calculation was made to calculate the chemical radius of influence during injection, and then non-pumping flow was estimated using the Darcy flow equation:

v = K*i/n, where

v = seepage velocity

K = hydraulic conductivity

I = hydraulic gradient

n = porosity

Since the monitor wells are located immediately down-gradient of the injection wells, it is anticipated that injected fluid will reach each of the three monitor wells.

Table 2 – Travel Times to Monitor Wells, 1855 Source Area

Monitor Well	Distance From Nearest Injection Point To Monitor Well, Feet	Travel Time To Monitor Well, Days
2011	5	0.04
New Monitor Well – 1	30	25
New Monitor Well – 2	60	56

Assumptions:

- Hydraulic Conductivity = 0.06 ft/min (Harza, 1989. *Phase E Site Assessment Report*)
- Porosity = 0.30 (Fetter, 1988. *Applied Hydrogeology)*
- Saturated Thickness = 1.5 feet (CMS Report conceptual design)
- Volume Injected = 260 gallons (including 10 gallon flush of clean water)
- Injection Rate = 5 gpm (CMS Report conceptual design)
- Chemical Radius of Influence at end of injection period = 5.0 feet (calculated)
- Static Hydraulic Gradient = 0.003 ft/ft (Based on Q2 2010 potentiometric map, CMS Report)

4.1.3 1831 Floodplain Source Area

Based on the anticipated footprint of the treatment area (approximately 50 feet by 100 feet), the proposed Pilot-Scale Treatability Study will encompass the entire area of the proposed full-scale treatment area. The Pilot-Scale Treatability Study for this source area will consist of the injection of the selected chemical oxidant into 14 pilot injection wells, shown in blue on Figure 13.

Bioenhancement chemical injection will utilize the five southern-most (up-gradient) pilot injection wells, and will be scheduled approximately twelve weeks following the completion of chemical oxidant injection.

Performance monitoring will include monitor wells 1831, 1833, 1834, 1832, and 1876. Data gathered during performance of this monitoring will be used to confirm the quantity of bioenhancement chemical to be injected, which will be provided in the brief letter report.

Figure 13 – Floodplain – 1831 Source Area Pilot-Scale Locations

Table 3 provides information regarding distance from the pilot injection wells and estimated travel times of oxidant solution to the five monitor wells. These estimations of groundwater travel times use simplified water flow assumptions (see Attachment 2). A volumetric calculation was made to calculate the chemical radius of influence during injection, and then non-pumping flow was estimated using the Darcy flow equation:

v = K*i/n, where

v = seepage velocity

K = hydraulic conductivity

I = hydraulic gradient

n = porosity

Since monitor wells 1832 and 1876 are located generally hydraulically up-gradient of the injection wells, it is likely that injected fluid will not reach these two monitor wells. However, since the groundwater flow direction and gradient in the floodplain area is variable and dependent upon flood stage of the Wabash River, these two wells will be monitored to see if any response is observed.

Table 3 – Travel Times to Monitor Wells, 1831 Floodplain Source Area

Monitor Well	Distance From Nearest Injection Point To Monitor Well, Feet	Travel Time To Monitor Well, Days
1831	10	5
1834	50	29
1833	100	58
1832	100	------
1876	120	------

Assumptions:

- Hydraulic Conductivity = 0.008 ft/min (Harza, 1989. *Phase E Site Assessment Report*)
- Porosity = 0.35 (Fetter, 1988. *Applied Hydrogeology)*
- Saturated Thickness = 20 feet (CMS Report conceptual design)
- Volume Injected = 300 gallons (including 50 gallon flush of clean water)
- Injection Rate = 5 gpm (CMS Report conceptual design)
- Chemical Radius of Influence at end of injection period = 1.4 feet (calculated)
- Static Hydraulic Gradient = 0.05 ft/ft (Based on Q2 2010 potentiometric map, CMS Report)

4.2 PERMITTING

Wells for the injection of chemical oxidants may be considered Class V injection wells as per the federal Underground Injection Control (UIC) Program, which falls under the federal Safe Drinking Water Act (SDWA). Prior to performing the Pilot-Scale Treatability Study, Lilly will contact both IDEM and U.S. EPA and confirm whether injection of chemical oxidants would require a permit. If required, a permit application form will be completed and submitted to the IDEM/U.S. EPA UIC Program.

4.3 INJECTION WELL/POINT INSTALLATION

4.3.1 Main Plant Source Area Injection Well Installation

To allow for selection of the oxidant injection zone, the depth to groundwater, saturated soil lithology, well screened intervals, and primary COC concentrations for monitor wells located within the footprint of the proposed treatment area must be understood. Table 4 presents a summary of this information, and Figures 14 and 15 present cross-sections of the main plant treatment area. The orientation of the cross-sections are presented on Figure 11. Soil boring logs for existing monitor wells are included in Attachment 1.

Table 4 - Main Plant Source Area Data Summary

Well ID	Depth to Water (feet bgs)	Depth Interval (feet bgs)	Lithology	Screen Interval (feet bgs)	Depth Discrete Sampling Interval	Benzene (ug/L)	CB (ug/L)	pCBT (ug/L)	THF (ug/L)	n,n-DEA (ug/L)
1809	61	50 - 70	Sand, F. - C, with Gravel							
		70 - 75	Clay	74 - 94	74 - 94	4,367.60	356.23	0.08	17,491.23	19,905.24
		75+	???							
1814	61	54 - 67	Sand, Fine with Gravel	55 - 67	61 - 90	1,506.85	116.60	0.29	176.81	14,015.58
		67 - 87	Clay	80 - 90						
		87 - 88	sand and Gravel							
		88 - 90	Sandy Clay							
		90	Clay							
1815	64	43 - 68.5	Sand, Gravelly	66 - 96	66 - 96	17,019.16	372.21	0.06	242,640.43	12,636.53
					66 - 69	5,338.72	488.30	0.07	28,208.93	11,545.70
		68.5 - 70.5	Silty Sand and Clay							
		70.5 - 78	Silty Clay and Silt							
		78 - 96	Silty Sand and Sand		78 - 81	8,867.50	456.78	0.05	48,921.13	11,796.17
					93 - 96	37,358.93	88.72	<2.0	928,397.05	5,802.16
		96 - 98	Silty Clay							
1818	63	45 - 66	Sand, Fine to Coarse	44.5 - 64.5	63 - 84.5	225.04	445.20	0.38	3.47	6,888.54
		66 - 78	Sandy Clay	74.5 - 84.5	75 - 78	69.52	539.26	0.43	<0.73	5,554.78
		78 - 98	Clay							
1819	61	61 - 82	Gravelly Sand	54 - 89	61 - 89	6.05	45.41	<0.02	<0.73	9,696.16
					61 - 64	16.01	827.00	0.34	<0.73	13,714.90
					70 - 73	7.70	333.05	0.14	<0.73	7,076.31
					79 - 82	4.61	98.74	0.06	<0.73	2,923.62
		82 - 94	Silty Sand							
		94 - 98	Clay							
1880	64	61.5 - 66	Sandy Clay Loam	63 - 68	63 - 68	1,301.10	48.21	0.70	891.71	70,677.24
		66 - 68	Sand with Gravel							
		68	Clay							
1908	62	No Log		67 - 72	67 - 72	0.22	7.79	1.18	ND	ND

Interval Samples - Collected June - July 2009
Discrete Samples - Collected Q3 2009
Screened intervals only present screen that extends across a saturated interval. Screened intervals in the vadose zone are not presented.

Based on the preliminary ISCO approach and the area-specific information summarized above, a total of three injection wells will be installed for the Pilot-Scale Treatability Study. One of these injection wells will have already been installed during sampling for the Bench-Scale Treatability Study.

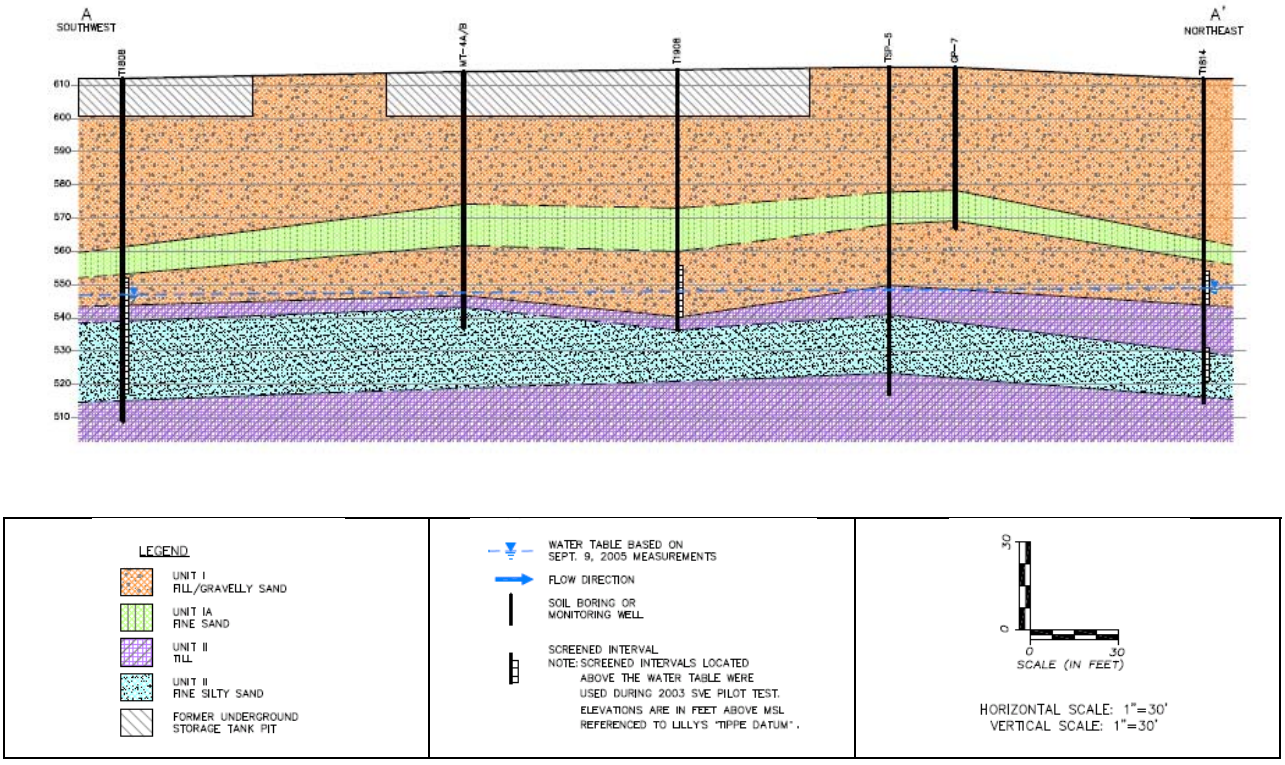

Figure 14 – Main Plant Source Area Cross Section A-A'

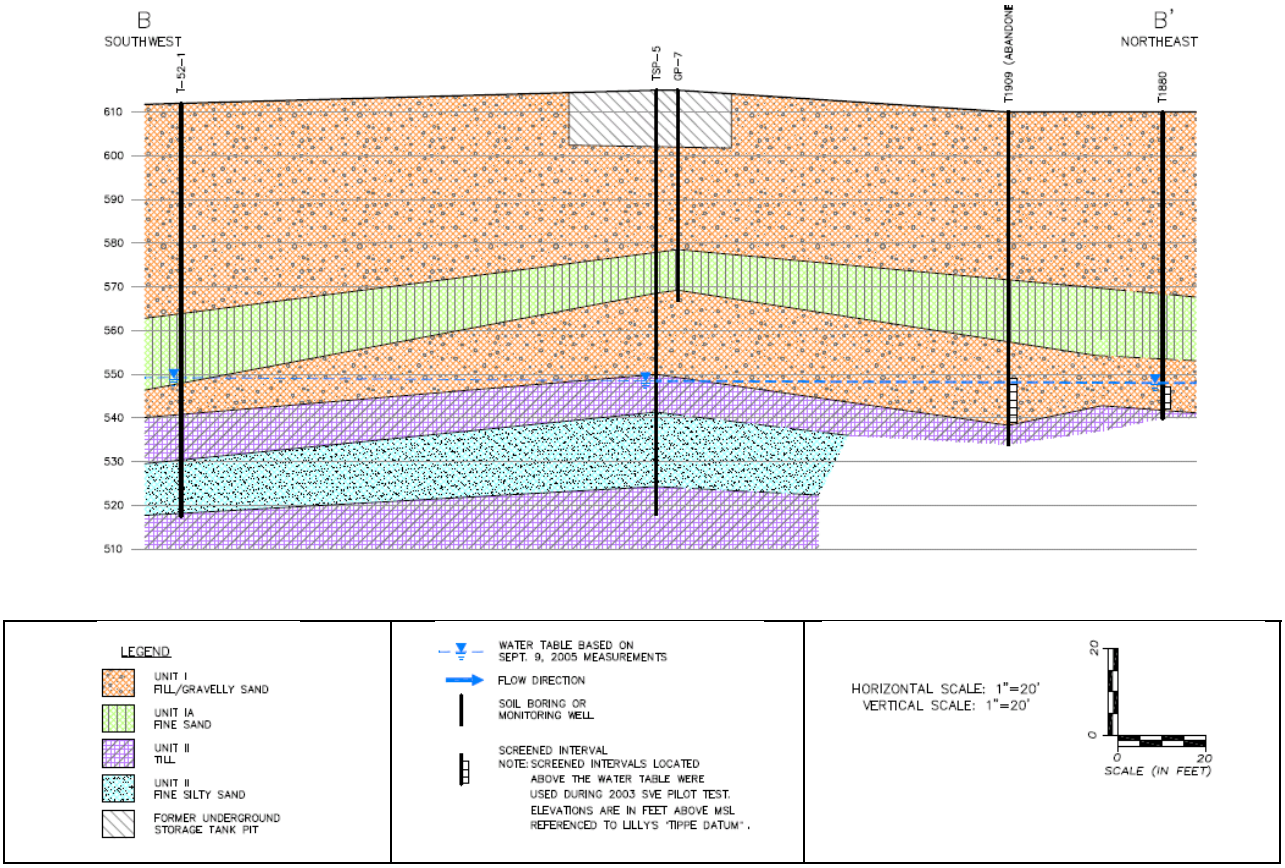

Figure 15 – Main Plant Source Area Cross Section B-B'

4.3.1.1 Utility Clearance

Prior to initiation of subsurface field activities, a site reconnaissance will be completed to stake and clear the proposed investigation locations. After location staking, Evonik will be contacted to identify subsurface utilities located in investigation area.

4.3.1.2 Soil Boring/Injection Well Installation

Soil borings required for injection well installation will be advanced with a truck-mounted, hollow-stem auger drilling rig or sonic rig. Soil samples will be collected continuously from five feet above the water table to the total depth of the soil boring, estimated to range between 55 and 90 feet bgs.

Once the soil samples are aboveground, a field representative will describe the soils according to the USCS, equivalent to ASTM D2488. In addition, a portion of each soil sample will be placed into individual Ziploc bags and the headspace gas will be monitored with a PID. This field screening technique, along with visual and olfactory observations of the soil, will be utilized to select two soil samples from each location for chemical analyses from the saturated interval. Documented observations of the soil samples will consist of sample depth, lithology, color, structure, staining, degree of sample saturation, and the presence or absence of hydrocarbon odors. An Indiana LPG will sign off on the geologic boring logs.

After reaching the soil boring target depth, the inner rod of the augers will be removed and well completion procedures will commence. The injection wells will be constructed by installing screen across the entire Unit I saturated interval, based on historic data and field observations. Wells will be completed with 0.040-inch slotted, 2-inch diameter, Schedule 40, flush threaded PVC screen; and 2-inch diameter, Schedule 40, flush threaded PVC casing to extend the well to ground surface.

Upon completion of well casing and screen installation, filter pack will be placed within the annular space between the injection well casing and screen and the hollow-stem augers to a height of approximately two feet above the screened interval. Concurrent with filter pack installation, the augers will be removed. This completion procedure will ensure that filter pack will be appropriately placed in the well completion. Thereafter, approximately two feet of granular bentonite will be installed above the filter pack and a cement/bentonite grout will be installed from the bentonite seal to the base of the locking-cap assembly. The injection well will then be completed within flush-mounted well completions, slightly elevated from the surrounding paved surfaces.

The following information will be entered into the well construction log:

- Project name;
- Project location;
- Drilling subcontractor;
- Field representative;
- Well identification;
- Date installed;
- Completion materials and corresponding depths (bgs);
- Top-of-casing and ground level elevations; and,
- Surface completion.

After the cement and concrete are allowed to cure for approximately 24 hours, well development activities will commence. Development activities will continue until developed water is relatively free of suspended sediment and field pH, specific conductance, and temperature measurements are equilibrated. Upon well completion, an Indiana-licensed public land surveyor will be retained to establish top-of-casing elevation for the newly installed wells.

Following completion of the Pilot-Scale Treatability Study, pilot injection wells will be considered for plugging in accordance with 312 IAC 13-10-2. A final recommendation as to whether the injection wells will be plugged will be made in the Final Treatability Study Report.

4.3.1.3 Analytical Laboratory Testing

Soil samples will be placed into laboratory provided sample containers and labeled with the following information: location, ID number, sample container, depth (soil), date, time, and sampling personnel. This information will also be entered on a chain-of-custody form. Soil samples will be placed into a cooler and chilled to a temperature of approximately 4°C for shipment to a Heritage Environmental Services, LLC laboratory in Indianapolis, Indiana for analysis of VOCs by U.S. EPA Test Method 8260, SVOCs by U.S. EPA Test Method 8270, and metals by U.S. EPA Test Method 6010/7000.

4.3.1.4 Decontamination and Field Derived Waste Disposal

Drilling and sampling equipment will be decontaminated prior to the initiation of soil boring/well installation activities. Decontamination fluids and personal protective equipment generated during the field investigation will be stored on-site in drums and properly disposed at the completion of field activities and receipt of analytical results.

4.3.2 1855 Source Area Injection Well Installation

To allow for selection of the oxidant injection zone, the depth to groundwater, saturated soil lithology, well screened intervals, and primary COC concentrations for monitor wells located within the footprint of the proposed treatment area must be understood. Table 5 presents a summary of this information, and Figure 16 presents a cross-section of the 1855 treatment area. The orientation of the cross-section is presented on Figure 12. Soil boring logs for existing monitor wells are included in Attachment 1.

Table 5 – 1855 Source Area Data Summary

Well ID	Depth to Water (feet bgs)	Depth Interval (feet bgs)	Lithology	Screen Interval (feet bgs)	Depth Discrete Sampling Interval	Benzene (ug/L)	CB (ug/L)	pCBT (ug/L)	THF (ug/L)	n,n-DEA (ug/L)
1837	65	4 - 66	Sand and Gravel	63-68	65-68	ND	ND	410.25	ND	ND
		66 - 70	Clayey Till							
1838	65	63 - 72.5	Sand, Med - C.	78-83	78-83	ND	0.78	0.21	ND	1.87
		72.5 - 83	Sand, C. - Sm. Gravel							
		83 - 90	Sand, Fine							
1855	69.5	63.5 - 69	Sand, Med -C. w/Gravel	67.5 - 72.5	69.5 - 72.5	ND	ND	114.44	ND	ND
		69 - 75.5	Clay							
2010	NM	No Log		63-68	63-68	NM	NM	30	NM	NM
2011	NM	No Log		68-73	68-73	NM	NM	500	NM	NM
2012	NM	No Log		67-72	67-72	NM	NM	52	NM	NM
2013	NM	No Log		65-70	65-70	NM	NM	8.9	NM	NM
2014	NM	No Log		67-72	67-72	NM	NM	360	NM	NM

Interval Samples - Collected Q4 2009

Screened intervals only present screen that extends across a saturated interval. Screened intervals in the vadose zone are not presented.

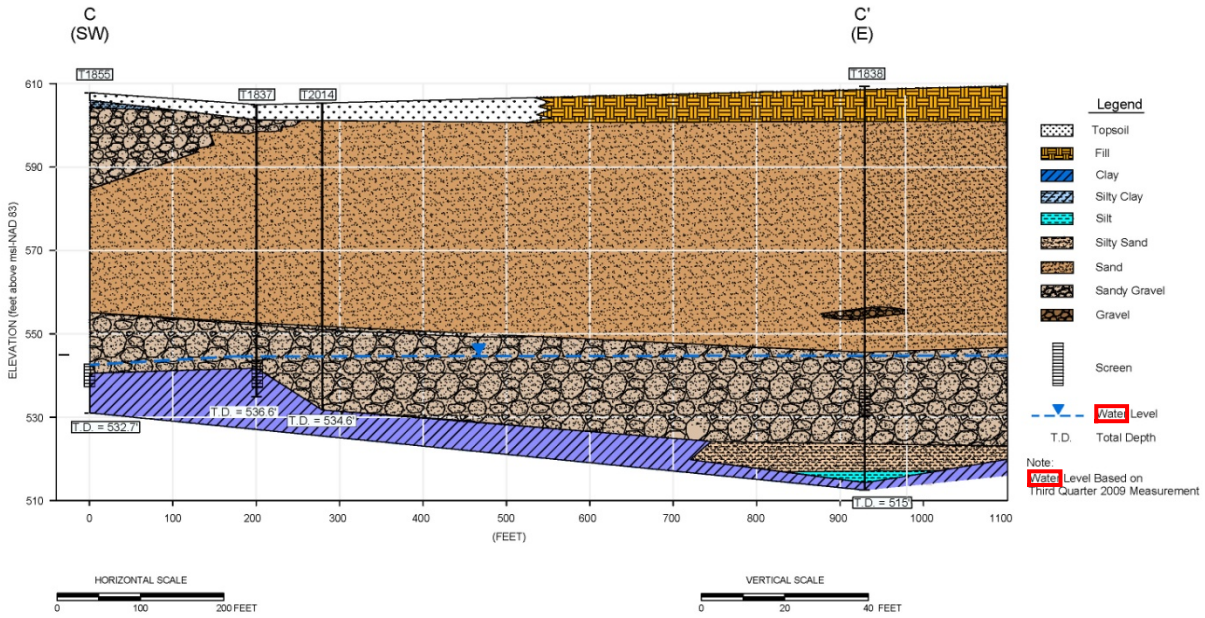

Figure 16 – 1855 Source Area Cross Section C-C'

Based on the preliminary ISCO approach and the area-specific information summarized above, a total of three injection wells and two new monitor wells will be utilized for the Pilot-Scale Treatability Study. All five of these wells would have been installed during sampling for the Bench-Scale Treatability Study.

Following completion of the Pilot-Scale Treatability Study, pilot injection wells will be considered for plugging in accordance with 312 IAC 13-10-2. A final recommendation as to whether the injection wells will be plugged will be made in the Final Treatability Study Report.

4.3.3 1831 Floodplain Source Area

To allow for selection of the oxidant injection zone, the depth to groundwater, saturated soil lithology, well screened intervals, and primary COC concentrations for monitor wells located within the footprint of the proposed treatment area must be understood. Table 6 presents a summary of this information, and Figures 17 and 18 present cross-sections of the floodplain treatment area. The orientation of the cross-sections is presented on Figure 13. Soil boring logs for existing monitor wells are included in Attachment 1.

Table 6 – 1831 Floodplain Source Area Data Summary

Well ID	Depth to Water (feet bgs)	Depth Interval (feet bgs)	Lithology	Screen Interval (feet bgs)	Depth Discrete Sampling Interval	Benzene (ug/L)	CB (ug/L)	pCBT (ug/L)	THF (ug/L)	n,n-DEA (ug/L)
1831	10.75	9 - 11	Clayey Sand, F-M	23-28	23-28	697.64	201.66	0.16	2,422.80	ND
		11 - 24	Silty Clay							
		24 - 27	Silty Sand, F-C							
		27 - 30	Silty Sand, F							
1832	12.22	10.5 - 15	Silty Sand, F-C	13-18	13-18	5.54	184.38	4.16	ND	5.91
		15 - 22	Silty Clay							
1833	5.44	0 - 9	Silty Clay	13-18	13-18	ND	ND	0.10	ND	ND
		9 - 11	Clayey Silt							
		11 - 18.5	Sand and Gravel, M-C							
1834	9.98	4 - 21.5	Silty Clay	22.5-27.5	22.5-27.5	0.31	14.59	ND	ND	0.34
		21.5 - 30	Sand, M-C							
1876	12.9	12.3 - 18	Silty Sand, F-C	13-18	13-18	2.81	4.73	ND	ND	43.23
		18 - 21	Sand							

Interval Samples - Collected Q3 2009
Screened intervals only present screen that extends across a saturated interval. Screened intervals in the vadose zone are not presented.

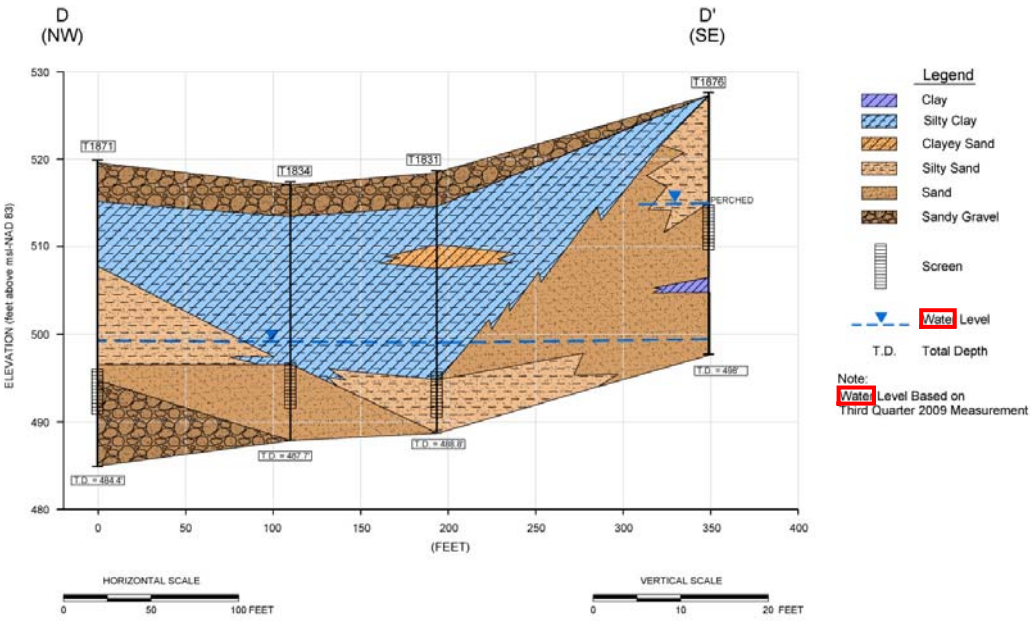

Figure 17 – 1831 Floodplain Source Area Cross Section D-D'

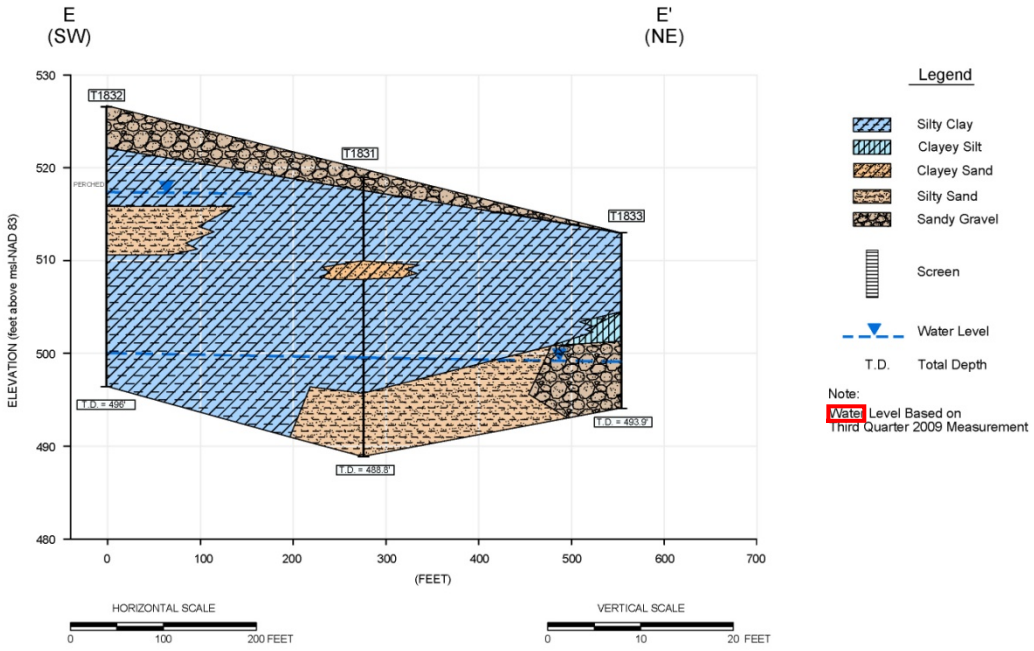

Figure 18 – 1831 Floodplain Source Area Cross Section E-E'

Based on the preliminary ISCO approach and the area-specific information summarized above, a total of 14 pilot injection wells will be installed for the Pilot-Scale Treatability Study.

4.3.3.1 Utility Clearance

Prior to initiation of subsurface field activities, a site reconnaissance will be completed to stake and clear the proposed investigation locations. After location staking, Evonik will be contacted to identify subsurface utilities located in investigation area.

4.3.3.2 Soil Boring/Monitor Well Installation

Soil borings required for injection well installation will be advanced with direct-push technology, a truck-mounted, hollow-stem auger drilling rig or sonic rig. Soil samples will be collected continuously from the ground surface to the total depth of the soil probe, estimated to be a maximum depth of 30 feet bgs.

Once the soil samples are aboveground, a field representative will describe the soils according to the USCS, equivalent to ASTM D2488. In addition, a portion of each soil sample will be placed into individual Ziploc bags and the headspace gas will be monitored with a PID. This field screening technique, along with visual and olfactory observations of the soil, will be utilized to select soil samples for chemical analyses from the saturated interval. It is anticipated that three soil samples (i.e., 10-11, 17-18, and 25-26 feet bgs) will be collected from three soil probes advanced to the north, hydraulically down-gradient of monitor well 1831. Documented observations of the soil samples will consist of sample depth, lithology, color, structure, staining, degree of sample saturation, and the presence or absence of hydrocarbon odors. An Indiana LPG will sign off on the geologic boring logs.

After reaching the soil boring target depth of 30 feet bgs, injection wells will be constructed by installing 20 feet of 2-inch diameter, Schedule 40, flush threaded PVC screen; and 2-inch diameter, Schedule 40, flush threaded PVC casing to extend the well to ground surface. Actual depth intervals may vary based on field conditions observed at the time of well installation.

Upon completion of well casing and screen installation, filter pack will be placed within the annular space between the injection well casing and screen and the hollow-stem augers to a

height of approximately two feet above the screened interval. Thereafter, approximately two feet of granular bentonite will be installed above the filter pack and a cement/bentonite grout will be installed from the bentonite seal to the base of the locking-cap assembly. The injection well will then be completed within flush-mounted well completions, slightly elevated from the surrounding ground surface.

The following information will be entered into the injection well construction log:

- Project name;
- Project location;
- Drilling subcontractor;
- Field representative;
- Well identification;
- Date installed;
- Completion materials and corresponding depths (bgs);
- Top-of-casing and ground level elevations; and,
- Surface completion.

After the cement and concrete are allowed to cure for approximately 24 hours, well development activities will commence. Development activities will continue until developed water is relatively free of suspended sediment and field pH, specific conductance, and temperature measurements are equilibrated. Upon well completion, an Indiana-licensed public land surveyor will be retained to establish top-of-casing elevation for the newly installed wells.

Following completion of the Pilot-Scale Treatability Study, pilot injection wells will be considered for plugging in accordance with 312 IAC 13-10-2. A final recommendation as to whether the injection wells will be plugged will be made in the Final Treatability Study Report.

4.3.3.3 Analytical Laboratory Testing

A portion of soil from each sample interval will be placed into laboratory provided sample containers and labeled with the following information: location, ID number, container number, depth (soil), date, time, and sampling personnel. This information will also be entered on a chain-of-custody form. Soil samples will be placed into a cooler and chilled to a temperature of approximately 4^{o}C for shipment to a Heritage Environmental Services, LLC laboratory in Indianapolis, Indiana for analysis of VOCs by U.S. EPA Test Method 8260, SVOCs by U.S. EPA Test Method 8270, and metals by U.S. EPA Test Method 6010/7000.

4.3.3.4 Decontamination and Field Derived Waste Disposal

Drilling and sampling equipment will be decontaminated prior to the initiation of soil boring/well installation activities. Decontamination fluids and personal protective equipment generated during the field investigation will be stored on-site in drums and properly disposed at the completion of field activities and receipt of analytical results.

4.4 APPLICATION METHOD, DOSAGE, AND MONITORING

4.4.1 Application Method

The application method chosen for the Pilot-Scale Treatability Study is based on known subsurface conditions and vendor recommendations. The bioenhancement injection program will be conducted approximately twelve weeks after the completion of the oxidant injection program within each of the three source areas. Confirmation of the effectiveness of the oxidant and bioenhancement injection programs will be verified during injection and following the Pilot-Scale Treatability Study.

4.4.1.1 Main Plant Source Area

Application of oxidant will occur through the simultaneous injection across the entire screened interval for the three injection wells, matching the vertical saturated thickness of the water-bearing unit. Equipment used for performance of this activity will include the following:

- Mixing tanks (i.e., oxidant and bioenhancement chemical)
- Injection pump rated for 5 gallons per minute (gpm) @ 200 pounds per square inch (psi)
- Injection hosing and a pressure relief valve with a bypass to a "blow-down" tank
- Hosing between mixing tank/drum and pump
- Pressure gauges
- Power drill paint stirrer (3-inch diameter or smaller propeller tip)
- Plastic bucket lid puller tool/opener tool
- 5-amp sump pump (such as Little Giant) and hose
- Access to water or mobile water storage tank
- Access to electricity or electrical generator

4.4.1.2 1855 Source Area

Application of oxidant will occur through the simultaneous injection across the entire screened interval for the three injection wells, matching the vertical saturated thickness of the water-bearing unit. Equipment used for performance of this activity will include the following:

- Mixing tanks (i.e., oxidant and bioenhancement chemical)
- Injection pump rated for 5 gpm @ 200 psi
- Injection hosing and a pressure relief valve with a bypass to a "blow-down" tank
- Hosing between mixing tank/drum and pump
- Pressure gauges
- Power drill paint stirrer (3-inch diameter or smaller propeller tip)
- Plastic bucket lid puller tool/opener tool
- 5-amp sump pump (such as Little Giant) and hose
- Access to water or mobile water storage tank
- Access to electricity or electrical generator

4.4.1.3 1831 Floodplain Source Area

Application of oxidant will occur through the simultaneous injection across the entire screened interval for five, then four, then five injection wells, matching the vertical saturated thickness of the water-bearing unit. Equipment used for performance of this activity will include the following:

- Mixing tanks (i.e., oxidant and bioenhancement chemical)
- Injection Pump rated for 5 gpm @ 200 psi
- Injection hosing and a pressure relief valve with a bypass to a "blow-down" tank
- Hosing between mixing tank/drum and pump
- Pressure gauges
- Power drill paint stirrer (3-inch diameter or smaller propeller tip)
- Plastic bucket lid puller tool/opener tool
- 5-amp sump pump (such as Little Giant) and hose
- Access to water or mobile water storage tank
- Access to electricity or electrical generator

4.4.2 Application Dosage

A proposed Pilot-Scale application dosage for the chemical oxidant in each source area will be determined following the Bench-Scale Test, and proposed in the Technical Memorandum. This dosage will be determined based upon expected field conditions, COC concentrations within each Pilot Area, and the results of the Bench-Scale Test.

However, injection rates will have to be determined in the field during the Pilot-Scale Test at each location. Until that time, the ability to inject proposed volumes of material into the treatment zones will not be known.

Similar injection rates will likely be assumed for the bioenhancement product injection as what are achieved during the ISCO phase of the Pilot-Scale Test.

Data collected during both phases of the Pilot-Scale Test will be used to refine the dosages and injection rates to be used during the full-scale implementation.

4.4.2.1 Main Plant Source Area

Table 7 presents a summary of the information required to develop applicable application rates for the Main Plant Source Area. Information obtained from the Bench-Scale Treatability Study will be used to identify the oxidant and to estimate the quantity of oxidant and injection rate.

Table 7 - Main Plant Source Area Application Rate

Area of Treatment	15,000 square feet
Treatment Thickness	18 feet
Volume of Area	10,000 cubic yards
Estimated COC Mass in Treatment Area (Dissolved-Phase Only)	Benzene: 1,750 grams CB: 650 grams THF: 850 grams pCBT: 0 grams n,n-DEA: 72,000 grams Other: 6,150 grams Total: 81,400 grams
Estimated Chemical Oxidant Dosage	To Be Determined During Bench-Scale
Estimated Injection Rate	To Be Determined in the field
Oxidant Flushing After Placement	Approximately 50 gallons of potable water will be used to flush the injection well and help distribute the injected oxidant.
Extraction Well Startup and Monitoring	Extract from 1880, and monitor at monitor wells 1818, 1908, 1814, 1808, and 1880 (after operation of this well ceases)
Bioenhancement Injection Timing	Approximately twelve weeks following the final chemical oxidant injection
Estimated Bioenhancement Dosage	To Be Determined Following Bench-Scale, dependant upon chemical oxidant dosage, and monitoring conducted during the oxidant phase of the pilot-scale testing.
Estimated Injection Rate	To Be Determined in the field

Start pumping extraction well 1880 five days prior to starting injection. Continue pumping while performing injection activities, until field monitoring indicates a chemical response at the extraction well, then the extraction well will be turned off. Distribution of the oxidant will be tracked through field monitoring of pH, dissolved oxygen (DO), and oxygen reduction potential (ORP).

4.4.2.2 1855 Source Area

Table 8 presents a summary of the information required to develop applicable application rates for the 1855 Source Area. Information obtained from the Bench-Scale Treatability Study will be used to identify the oxidant and to estimate the quantity of oxidant and injection rate.

Table 8 - 1855 Source Area Application Rate

Area of Treatment	600 square feet
Treatment Thickness	1.5 feet
Volume of Area	33 cubic yards
Estimated COC Mass in Treatment Area (Dissolved-Phase Only)	Benzene: 0 grams CB: 0 grams THF: 0 grams pCBT: 5 grams n,n-DEA: 0 grams Other: 0 grams Total: 5 grams
Estimated Oxidant Dosage	To Be Determined During Bench-Scale
Estimated Injection Rate	To Be Determined in the field
Oxidant Flushing After Placement	Approximately 10 gallons of potable water will be used to flush the injection well and help distribute the injected oxidant.
Bioenhancement Injection Timing	Approximately twelve weeks following the final chemical oxidant injection
Estimated Bioenhancement Dosage	To Be Determined Following Bench-Scale, dependant upon chemical oxidant dosage, and monitoring conducted during the oxidant phase of the pilot-scale testing.
Estimated Injection Rate	To Be Determined in the field

4.4.2.3 1831 Floodplain Source Area

Table 9 presents a summary of the information required to develop applicable application rates for the 1831 Floodplain Source Area. Information obtained from the Bench-Scale Treatability Study will be used to identify the oxidant and to estimate the quantity of oxidant and injection rate.

Table 9 - 1831 Floodplain Source Area Application Rate

Area of Treatment	5,000 square feet
Treatment Thickness	20 feet
Volume of Area	3,700 cubic yards
Estimated COC Mass in Treatment Area (Dissolved-Phase Only)	Benzene: 280 grams CB: 190 grams THF: 2,940 grams pCBT: 0 grams n,n-DEA: 0 grams Other: 3,170 grams Total: 6,580 grams
Estimated Oxidant Dosage	To Be Determined During Bench-Scale
Estimated Injection Rate	To Be Determined in the field
Oxidant Flushing After Placement	Approximately 50 gallons of potable water will be used to flush the injection well and help distribute the injected oxidant.
Bioenhancement Injection Timing	Approximately twelve weeks following the final chemical oxidant injection
Estimated Bioenhancement Dosage	To Be Determined Following Bench-Scale, dependant upon chemical oxidant dosage, and monitoring conducted during the oxidant phase of the pilot-scale testing.
Estimated Injection Rate	To Be Determined in the field (Note that only five southern-most injection wells will be utilized)

4.4.3 Monitoring and Sample Collection/Analysis

Monitoring data collected during the Pilot-Scale Treatability Study can provide insight for the selection of monitoring parameters in the full-scale implementation. Parameters that exhibit little or no impact due to the treatment technology may be considered for deletion in the full-scale phase. Conversely, if additional monitoring parameters are deemed to be necessary during the Pilot-Scale Treatability Study to provide additional clarity on the effectiveness of treatment, they would be included in the monitoring efforts planned for the full-scale implementation.

4.4.3.1 Main Plant Source Area

Typical field instrument and groundwater sampling will be performed at monitor wells 1818, 1908, 1814, 1808, and 1880. Monitoring will continue for a period of three months following the bioenhancement injection (a total of six months after completing the oxidant injection). Table 10 provides a detailed monitoring schedule during and after the injection events.

Table 10 - Main Plant Source Area Pilot-Scale Monitoring Schedule

Event	Monitoring	Analysis
1	Prior to Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, SVOCs, metals, alkalinity, ammonia, carbon dioxide, chlorides, ferrous and dissolved iron, manganese, methane, nitrate, sulfate, fluoride, and aniline
	During Injection	Temperature, pH, specific conductance, DO, ORP
2	One Week After Completing Oxidant Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, SVOCs, metals, manganese, aniline, chlorides, and fluoride
3	One Month After Completing Oxidant Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, SVOCs, aniline, chlorides, and fluoride.
4	Two Months After Completing Oxidant Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, SVOCs, aniline, chlorides, and fluoride.

Event	Monitoring	Analysis
5	Three Months After Completing Oxidant Injection and Prior to Bioenhancement Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, SVOCs, metals, alkalinity, ammonia, carbon dioxide, chlorides, ferrous and dissolved iron, manganese, methane, nitrate, sulfate, fluoride, TOC and aniline
6	One Month After Bioenhancement Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, SVOCs, metals, alkalinity, ammonia, carbon dioxide, chlorides, ferrous and dissolved iron, manganese, methane, nitrate, sulfate, fluoride, TOC and aniline
7	Two Months After Bioenhancement Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, SVOCs, metals, alkalinity, ammonia, carbon dioxide, chlorides, ferrous and dissolved iron, manganese, methane, nitrate, sulfate, fluoride, TOC and aniline
8	Three Months After Bioenhancement Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, SVOCs, metals, alkalinity, ammonia, carbon dioxide, chlorides, ferrous and dissolved iron, manganese, methane, nitrate, sulfate, fluoride, TOC and aniline

Notes:

- Groundwater samples will be collected in accordance with the Groundwater QAPP Revision 3, dated May 2010.
- Field measurements of temperature, pH, specific conductance, DO, and ORP will be made immediately before injection starts and will continue on a frequent basis (to be determined in the field) throughout the period that chemical injection occurs.
- Use of bromide or other tracer may not be necessary based on the rapid chemical response typically associated with the proposed chemical oxidants and observed in pH, DO, and ORP. However, the usefulness of these field measurement parameters is highly dependent upon the particular chemical oxidant. Therefore, use of tracers will be re-evaluated following the bench-scale treatability study and final selection of the pilot-scale chemical oxidant.
- TICs reported by the laboratory will be documented to identify potential breakdown products.

In addition, soil samples are anticipated to be collected within three months after the final injection event from the locations shown in orange on Figure 19 (replicating the approximate locations and intervals tested prior to initiation of the Pilot-Scale Treatability Study) – located north of monitor well 1814 and the second location will be located southeast of monitor well 1815. The sample collected from the location southeast of 1815 is more of a control location and

may not be collected if definitive geochemical change in groundwater samples collected from nearby monitor wells does not indicate that oxidant reached this area.

Well ID	Screened Interval (ft. bgs)	DTW (ft. bgs)	Saturated Soil Type	Proposed Soil Sample Interval
1814	55 – 67	61	Fine Sand with Gravel	62 – 67
1815	66 – 96	64	Gravelly Sand	65 – 70

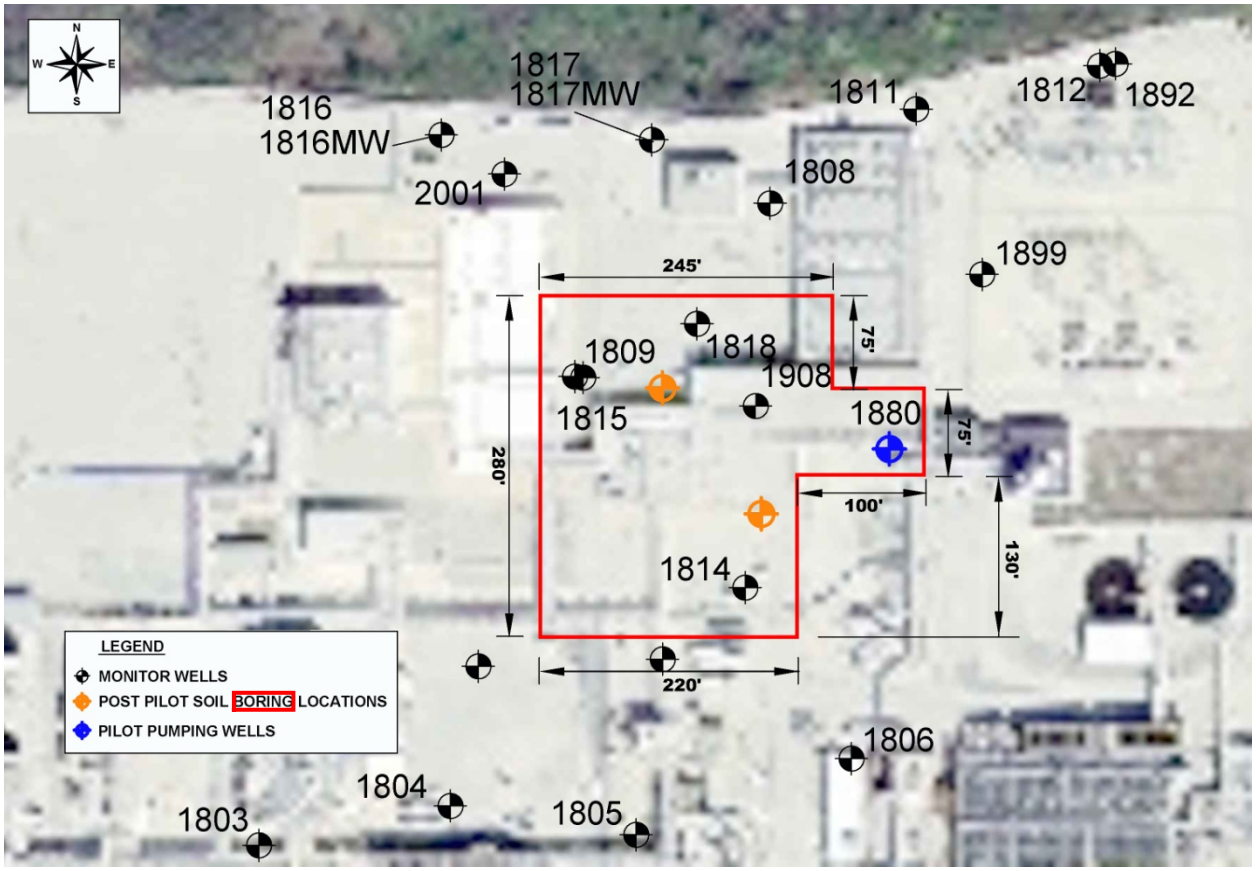

Figure 19 – Main Plant Source Area Post Pilot-Scale Sample Locations

This sampling will be performed to evaluate ISCO and enhanced bioremediation effectiveness on the saturated soils and subsurface conditions related to implementation of a full-scale treatment program.

4.4.3.2 1855 Source Area

In order to better assess the pilot-scale test, two additional monitor wells will be installed in the 1855 Source Area, one approximately 30 feet down-gradient of the pilot injection locations and one approximately 60 feet down-gradient of the pilot injection locations (see Figure 20). Typical field instrument and groundwater sampling will be performed at monitor well 2011 and the two newly installed monitor wells (NMW-1 and NMW-2). Monitoring will continue for a period of three months following the bioenhancement injection (a total of six months after completing the oxidant injection). Table 11 provides a detailed monitoring schedule during and after the injection events.

Table 11 - 1855 Source Area Pilot-Scale Monitoring Schedule

Event	Monitoring	Analysis
1	Prior to Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, metals, alkalinity, ammonia, carbon dioxide, chlorides, ferrous and dissolved iron, manganese, methane, nitrate, sulfate, and fluoride
	During Injection	Temperature, pH, specific conductance, DO, ORP
2	One Week After Completing Oxidant Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, metals, manganese, fluoride, and chlorides
3	One Month After Completing Oxidant Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, fluoride, and chlorides
4	Two Months After Completing Oxidant Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, fluoride, and chlorides
5	Three Months After Completing Oxidant Injection and Prior to Bioenhancement Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, metals, alkalinity, ammonia, carbon dioxide, chlorides, ferrous and dissolved iron, manganese, methane, nitrate, sulfate, fluoride, and TOC
6	One Month After Bioenhancement Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, metals, alkalinity, ammonia, carbon dioxide, chlorides, ferrous and dissolved iron, manganese, methane, nitrate, sulfate, fluoride, and TOC

Event	Monitoring	Analysis
7	Two Months After Bioenhancement Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, metals, alkalinity, ammonia, carbon dioxide, chlorides, ferrous and dissolved iron, manganese, methane, nitrate, sulfate, fluoride, and TOC
8	Three Months After Bioenhancement Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, metals, alkalinity, ammonia, carbon dioxide, chlorides, ferrous and dissolved iron, manganese, methane, nitrate, sulfate, fluoride, and TOC

Notes:

- Groundwater samples will be collected in accordance with the Groundwater QAPP Revision 3, dated May 2010.
- Field measurements of temperature, pH, specific conductance, DO, and ORP will be made immediately before injection starts and will continue on a frequent basis (to be determined in the field) throughout the period that chemical injection occurs.
- Use of bromide or other tracer may not be necessary based on the rapid chemical response typically associated with the proposed chemical oxidants and observed in pH, DO, and ORP. However, the usefulness of these field measurement parameters is highly dependent upon the particular chemical oxidant. Therefore, use of tracers will be re-evaluated following the bench-scale treatability study and final selection of the pilot-scale chemical oxidant.
- TICs reported by the laboratory will be documented to identify potential breakdown products.

In addition, soil samples will be collected within three months after the final injection event from the following locations shown in orange on Figure 20 (replicating the approximate locations and intervals tested prior to initiation of the Pilot-Scale Treatability Study).

Well ID	Screened Interval (ft. bgs)	DTW (ft. bgs)	Saturated Soil Type	Proposed Soil Sample Interval
2011	63 – 68	65	Sand and Gravel	68 – 70

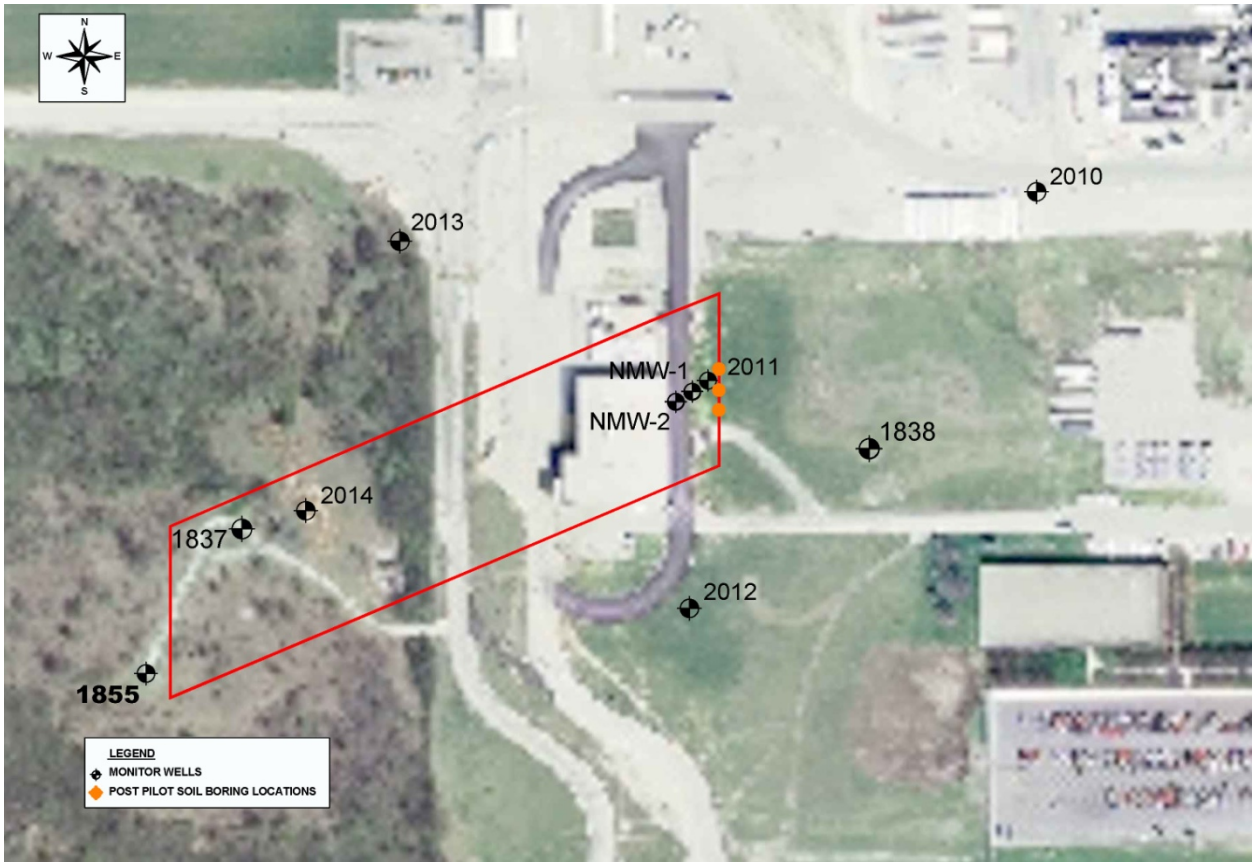

Figure 20 – 1855 Source Area Post Pilot-Scale Sample Locations

This sampling will be performed to evaluate ISCO and enhanced bioremediation effectiveness on the saturated soils and subsurface conditions related to implementation of a full-scale treatment program.

4.4.3.3 1831 Floodplain Source Area

Typical field instrument and groundwater sampling will be performed at monitor wells 1831, 1833, 1834, 1832, and 1876. Monitoring will continue for a period of three months following the bioenhancement injection (a total of six months after completing the oxidant injection). Table 12 provides a detailed monitoring schedule during and after the injection events.

Table 12 - 1831 Floodplain Source Area Pilot-Scale Monitoring Schedule

Sample Event	Monitoring	Analysis
1	Prior to Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, SVOCs, metals, alkalinity, ammonia, carbon dioxide, chlorides, ferrous and dissolved iron, manganese, methane, nitrate, sulfate, fluoride, and aniline
	During Injection	Temperature, pH, specific conductance, DO, ORP
2	One Week After Completing Oxidant Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, SVOCs, metals, manganese, aniline, chlorides, and fluoride
3	One Month After Completing Oxidant Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, SVOCs, aniline, chlorides, and fluoride
4	Two Months After Completing Oxidant Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, SVOCs, aniline, chlorides, and fluoride
5	Three Months After Completing Oxidant Injection and Prior to Bioenhancement Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, SVOCs, metals, alkalinity, ammonia, carbon dioxide, chlorides, ferrous and dissolved iron, manganese, methane, nitrate, sulfate, fluoride, TOC, and aniline
6	One Month After Bioenhancement Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, SVOCs, metals, alkalinity, ammonia, carbon dioxide, chlorides, ferrous and dissolved iron, manganese, methane, nitrate, sulfate, fluoride, TOC, and aniline
7	Two Months After Bioenhancement Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, SVOCs, metals, alkalinity, ammonia, carbon dioxide, chlorides, ferrous and dissolved iron, manganese, methane, nitrate, sulfate, fluoride, TOC, and aniline
8	Three Months After Bioenhancement Injection	Temperature, pH, specific conductance, DO, ORP, VOCs, SVOCs, metals, alkalinity, ammonia, carbon dioxide, chlorides, ferrous and dissolved iron, manganese, methane, nitrate, sulfate, fluoride, TOC, and aniline

Notes:

- Groundwater samples will be collected in accordance with the Groundwater QAPP Revision 3, dated May 2010.
- Field measurements of temperature, pH, specific conductance, DO, and ORP will be made immediately before injection starts and will continue on a frequent basis (to be determined in the field) throughout the period that chemical injection occurs.
- Use of bromide or other tracer may not be necessary based on the rapid chemical response typically associated with the proposed chemical oxidants and observed in pH, DO, and ORP. However, the usefulness of these field measurement parameters is highly dependent upon the particular chemical oxidant. Therefore, use of tracers will be re-evaluated following the bench-scale treatability study and final selection of the pilot-scale chemical oxidant.
- TICs reported by the laboratory will be documented to identify potential breakdown products.

In addition, soil samples will be collected within three months after the final injection event from locations replicating the approximate locations and intervals tested prior to initiation of the Pilot-Scale Treatability Study (within the area depicted in Figure 21).

Well ID	Screened Interval (ft. bgs)	DTW (ft. bgs)	Saturated Soil Type	Proposed Soil Sample Interval
1831	23 – 28	8.75	Clayey Sand	9 – 14
			Silty Clay	16 – 21
			Silty Sand	24 – 29

Figure 21 – 1831 Floodplain Source Area Post Pilot-Scale Sample Locations

This sampling will be performed to evaluate ISCO and enhanced bioremediation effectiveness on the saturated soils and subsurface conditions after completion of treatment.

4.4.3.4 Field Contingencies

The proposed Pilot-Scale Treatability Study injection locations, application rate, and field procedures may be revised based on field observations. Any such deviations from the Work Plan will be documented and the reasons for the deviation explained in the Pilot-Scale Treatability Study Report. Potential deviations and the general responses are provided below:

- **Underground utility identification.** If underground utilities are identified in a location where an injection point is planned, the location of the injection point will be moved to the nearest location to the proposed injection point that is at least 10 feet away from identified underground utilities.
- **Lack of response observed at monitor wells.** If no chemical response is recorded in the field at nearby monitor wells, additional chemical will be injected. Up to 150% of the original injection volume will be injected at the nearest injection location to the unresponsive monitor well. If no chemical response is observed after this additional injection quantity, injections will cease and monitoring will be continued. Analysis for metals will continue until after a chemical response is observed at the monitor well.
- **Loss of chemical injection control.** If injection chemical is observed at the surface emanating from monitor wells or other locations, chemical injection activities will cease to allow assessment of underground flow paths. Similarly, if any ground heaving, excessive injection back-pressure, or other evidence of a loss of chemical injection control is observed, chemical injection activities will cease to allow assessment of the cause of such loss of control. After a field assessment is made, injection activities would re-commence if appropriate.

4.5 REPORTING

Upon completion of the Pilot-Scale Treatability Study, a comprehensive report will be prepared that will present the data, discuss trends and anomalies, and present the findings regarding the overall viability of the remedial approach.

5.0 SCHEDULE

Table 13 provides a tentative schedule for performance of the Bench-Scale and Pilot-Scale Treatability Study at the Site. Implementation of field activities will be based on receipt of regulatory approval and seasonal weather conditions.

Table 13 - Bench-Scale and Pilot-Scale Treatability Study Schedule

Step	Activity	Duration
1	Submittal of Bench-Scale and Pilot-Scale Treatability Study Work Plan	April 2012
2	U.S. EPA Approval of Bench-Scale and Pilot-Scale Treatability Work Plan	
3	Supplemental Soil Characterization (1855)	30 Days
4	Bench-Scale Sample Collection (soil and groundwater) and Well Installation (concurrent with Step 3)	5 Days
5	Bench-Scale Treatability Study and Laboratory Testing	45 Days + 14 Days
6	Bench-Scale Treatability Study Technical Memorandum	60 Days
7	U.S. EPA Approval of Bench-Scale Treatability Study Technical Memorandum	
8	Pilot-Scale Treatability Study – Well Installation, Sampling, and Laboratory Testing	60 Days
9	Pilot-Scale Treatability Study – Chemical oxidant injection based on original projected injection quantity: Main Plant Source Area 1855 Source Area 1831 Floodplain Source Area	 3-5 Days 1-2 Days 3-5 Days
10	Pilot-Scale Treatability Study – Bioenhancement injection 12 weeks after chemical oxidant injection Main Plant Source Area 1855 Source Area 1831 Floodplain Source Area	 3-5 Days 1-2 Days 1-2 Days
11	Pilot-Scale Treatability Study – Monitoring (concurrent with Steps 9 and 10)	180 Days
12	Pilot-Scale Treatability Study – Post Treatment Soil Sampling and Laboratory Testing	21 Days
13	Reporting	60 days after receipt of final results
14	U.S. EPA Approval of Bench-Scale and Pilot-Scale Report	

ATTACHMENT 1

SOIL BORING LOGS

HARZA ENGINEERING COMPANY
Form SG–2
September 1978

GEOLOGIC LOG

T1805,
Sheet No. 1
Date

PROJECT EL C-Tippecanoe Labs

Hole No. TW-5 (1805) (1805)
Feature Main Plant Area
Coordinates: N 1147
E 127
Core Sizes —

Angle (from Horizontal) 90°
Bearing
Date Started 11/19/86
Date Completed 11/20/86
Total Depth 89 ft.

Ground Elevation 612 (est.)
~~Rock Elevation~~ 614.53 (top of casing)
Overburden Thickness
Ground Water Elevation 550.0
Logged by WRC

Elevation (Depth)	Graphic Log: Lithology	Graphic Log: Structure	Graphic Log: Attitude	Classification and Physical Condition	C.R.–Graphic	Core Rec. %	RQD %	Remarks (Sample Data, Water Levels, Drilling Characteristics etc.)
				Gravel, fill, rounded, max. size 1/2", some silt and fine to coarse sand				Wash Rotary
10				10				
				Gravel, clayey, brown, 10% fine sand				
				16				
20				Gravel, subrounded-rounded, max. size 1/2", with 10-25% coarse sand				
30								
				40				
40				Sand, fine to medium, rounded, with 10% gravel with max. size 1/4"				
50				54				
				Clay, gray, with 10% sand and gravel				
60								
				69				
70				Sand, fine, with trace gray clay				
				74				
				Gravel, small (max. size 1/4"), angular-subrounded, with 30% fine sand				
80				84				
				Clay, gray, with fine sand				Rig action indicates presence of cobbles
				89				
90				BOTTOM OF HOLE				
				6" Diam. st. steel 306 screen installed: 64-84'				

Harza Log Rewritten By ERM at the Request of Lilly (LW).

ERM, Inc.
11350 N. Meridian Street, Suite 220
Carmel, Indiana 46032
(317) 706-2000

Soil Boring Log

Boring No: T1808

Date: 11/2/88-12/2/88 **Proj. No.:** NA
Client: Eli Lilly
Drilling Company: Layne-Northern
Logged By: Harza Environmental Services, Inc.
Surface Elevation: 615.94 *
Total Depth: 103.0' **Diameter:** 8"
Comments: Northing: 1696.44 Easting: 428.23
* NAD (88) Datum

Project: ELC Tippe Labs Recovery Wells
Location: Lafayette, IN
Driller:
Drilling Method: Rotary, Cable Tool
Top of Casing Elevation 617.21 *
Sampling Method Bailer; sieve

Depth (ft.)	PID Reading	Blow Counts	Recovery (%)	Description/Soil Classification (Color, Texture, Structures)
0.0				
1.0				
2.0				
3.0				
4.0				
5.0				Sand brown M-crs trace silt. (Remarks: Run out of mud, hole collapsed)
6.0				
7.0				
8.0				
9.0				
10.0				Sand brown crs with silt, gravel 1" subrdd. (Remarks: Quit drilling 11/2/88 4:30)
11.0				
12.0				
13.0				
14.0				
15.0				SP: Sand brown gray, gravel 1/2" subrdd. (Remarks: Restart 11/8/88)
16.0				
17.0				
18.0				
19.0				
20.0				Sand crs brown
21.0				
22.0				
23.0				
24.0				
25.0				Same as above
26.0				
27.0				
28.0				
29.0				

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(317) 706-2000

Soil Boring Log

Boring No: T1808

Date: 11/2/88-12/2/88 **Proj. No.:** NA
Client: Eli Lilly
Drilling Company: Layne-Northern
Logged By: Harza Environmental Services, Inc.
Surface Elevation: 615.94 *
Total Depth: 103.0' **Diameter:** 8"
Comments: Northing: 1696.44 Easting: 428.23
* NAD (88) Datum

Project: ELC Tippe Labs Recovery Wells
Location: Lafayette, IN
Driller:
Drilling Method: Rotary, Cable Tool
Top of Casing Elevation 617.21 *
Sampling Method Bailer; sieve

Depth (ft.)	PID Reading	Blow Counts	Recovery (%)	Description/Soil Classification (Color, Texture, Structures)
29.0				
30.0				Sand m.silt about 10%
31.0				
32.0				
33.0				
34.0				
35.0				Sand m-crs no fines some cobbles. (Remarks: Switch for cable tool)
36.0				
37.0				
38.0				SP: Sand brown f-m
39.0				
40.0				
41.0				
42.0				
43.0				
44.0				Sand brown f-m gravelly
45.0				Gravel 1" poorly rounded, subangular
46.0				
47.0				
48.0				
49.0				
50.0				SW: Sand brown f-crs gravel well rounded 1/2"
51.0				
52.0				ML: Brown silt. (Remarks: Unit IA)
53.0				
54.0				
55.0				SW: Same as above
56.0				
57.0				
58.0				

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Soil Boring Log

Boring No: T1808

Date: 11/2/88-12/2/88 **Proj. No.:** NA
Client: Eli Lilly
Drilling Company: Layne-Northern
Logged By: Harza Environmental Services, Inc.
Surface Elevation: 615.94 *
Total Depth: 103.0' **Diameter:** 8"
Comments: Northing: 1696.44 Easting: 428.23
* NAD (88) Datum

Project: ELC Tippe Labs Recovery Wells
Location: Lafayette, IN
Driller:
Drilling Method: Rotary, Cable Tool
Top of Casing Elevation 617.21 *
Sampling Method Bailer; sieve

Depth (ft.)	PID Reading	Blow Counts	Recovery (%)	Description/Soil Classification (Color, Texture, Structures)
59.0				
60.0				Same as above
61.0				
62.0				Sand gray f-crs gravelly
63.0				Gravel 1" poorly rounded cobbles 2"-4"
64.0				SP: Black sand crs gravel 2" Sand Black m-crs some cobbles. (Remarks: Odor)
65.0				
66.0				
67.0				
68.0				Sand gray m-crs gravelly
69.0				ML: Silt gray. (Remarks: Unit IA)
70.0				
71.0				
72.0				
73.0				
74.0				SM: Sand v. fine silty, silt 20%. (Remarks: Unit IA)
75.0				
76.0				
77.0				
78.0				
79.0				SP: Sand gray fine
80.0				
81.0				
82.0				Same sand and gravel
83.0				
84.0				
85.0				Sand gray fine some gravel
86.0				
87.0				
88.0				Sand gray fine gravelly gravel 20% 1/2" rounded

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Soil Boring Log

Boring No: T1808

Date: 11/2/88-12/2/88 **Proj. No.:** NA
Client: Eli Lilly
Drilling Company: Layne-Northern
Logged By: Harza Environmental Services, Inc.
Surface Elevation: 615.94 *
Total Depth: 103.0' **Diameter:** 8"
Comments: Northing: 1696.44 Easting: 428.23
* NAD (88) Datum

Project: ELC Tippe Labs Recovery Wells
Location: Lafayette, IN
Driller:
Drilling Method: Rotary, Cable Tool
Top of Casing Elevation 617.21 *
Sampling Method Bailer; sieve

Depth (ft.)	PID Reading	Blow Counts	Recovery (%)	Description/Soil Classification (Color, Texture, Structures)
89.0				
90.0				
91.0				
92.0				Sand gray m-crs gravel 1" subrndd
93.0				
94.0				
95.0				Sand gray dense fine some gravel 1/2"
96.0				
97.0				CL: Gray clay
98.0				
99.0				
100.0				
101.0				
102.0				
103.0				
				EOB @ 103.0'

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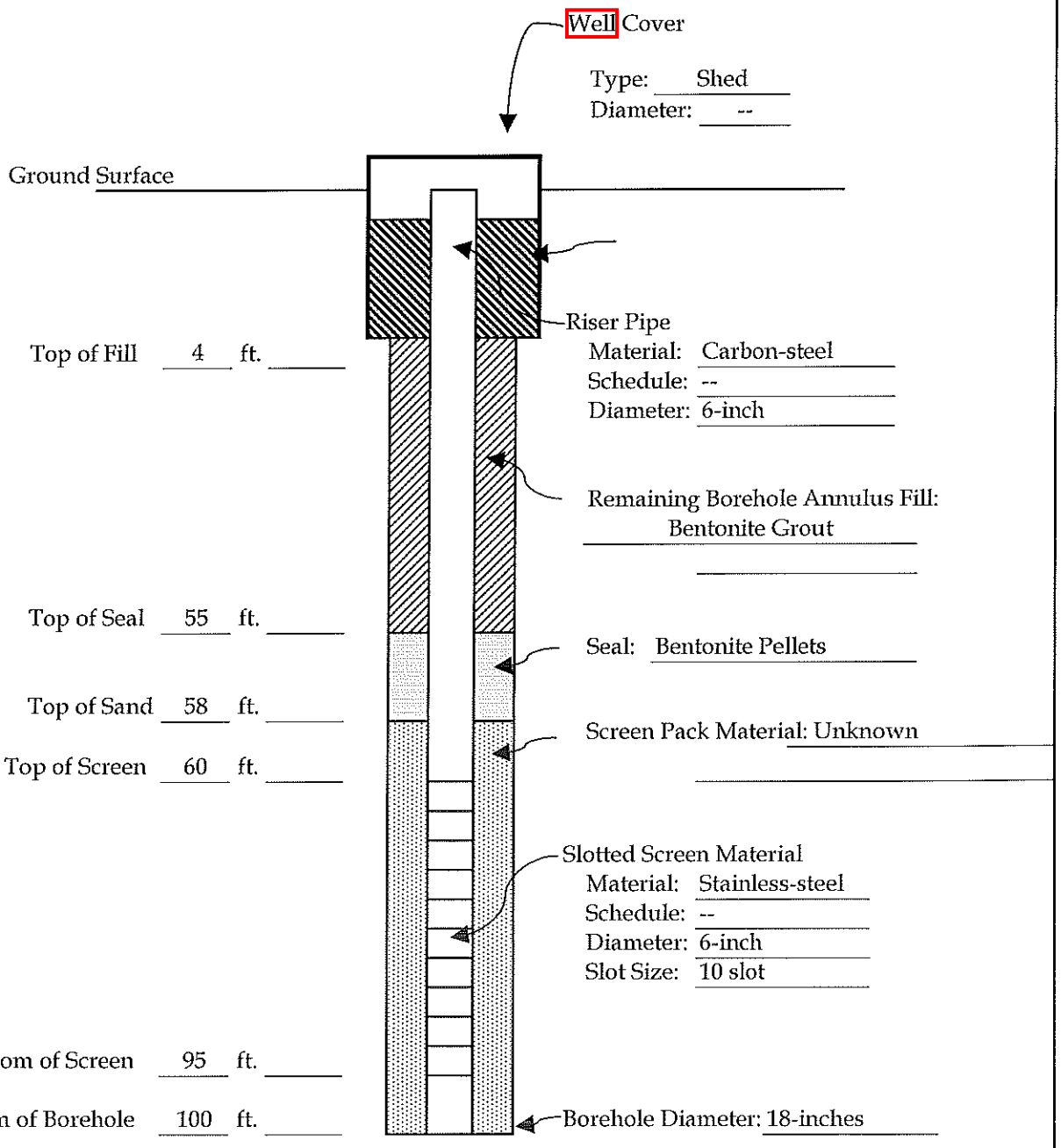
Well Construction Diagram

Well Identification: T1808

Client: Eli Lilly and Company
Project: Recovery Well Installation
Proj. No.: NA
ERM Geologist: NA
Drilling Company: Layne-Northern
Driller: Lewis Melling
Drilling Method: Cable Tool

Date Installed: 12/22/88
Development Method: Unknown
Water Removed During Development: Unknown
Static Water Level Depth/Elevation: Unknown
Northing/Easting: 1696.44/428.23
Top of Casing Elevation: 617.21
Ground Elevation: 615.94



Comments: Construction diagram was constructed from original Layne-Northern field forms.

Harza Log Rewritten by ERM at the request of Lilly (LW)

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Soil Boring Log

Boring No: T1809

Date: 11/1/88-12/14/88 **Proj. No.:** NA
Client: Eli Lilly
Drilling Company: Layne-Northern
Logged By: Harza Environmental Services, Inc.
Surface Elevation: 618.02 *
Total Depth: 75.0' **Diameter:** 8"
Comments: Northing: 1548.32 Easting: 280.19 (Lilly grid)
* NAD (88) Datum

Project: ELC Tippe Labs Recovery Wells
Location: Lafayette, IN
Driller:
Drilling Method: Rotary, Cable Tool
Top of Casing Elevation 619.03 *
Sampling Method Bailer; sieve

Depth (ft.)	PID Reading	Blow Counts	Recovery (%)	Description/Soil Classification (Color, Texture, Structures)
0.0				
1.0				Fill Brown Clayey Sand
2.0				
3.0				
4.0				
5.0				
6.0				
7.0				
8.0				
9.0				
10.0				
11.0				SP: Sand brown M-CRS gravelly, gravel 1" well rounded
12.0				
13.0				
14.0				
15.0				Sand brown as above
16.0				Cobbles
17.0				Sand multicolored coarse
18.0				No gravel
19.0				Sand as above
20.0				
21.0				
22.0				
23.0				
24.0				Sand brown med.
25.0				
26.0				
27.0				
28.0				(Remarks: Switch for cable tool)
29.0				

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Soil Boring Log

Boring No: T1809

Date: 11/1/88-12/14/88 **Proj. No.:** NA
Client: Eli Lilly
Drilling Company: Layne-Northern
Logged By: Harza Environmental Services, Inc.
Surface Elevation: 618.02 *
Total Depth: 75.0' **Diameter:** 8"
Comments: Northing: 1548.32 Easting: 280.19 (Lilly grid)
* NAD (88) Datum

Project: ELC Tippe Labs Recovery Wells
Location: Lafayette, IN
Driller:
Drilling Method: Rotary, Cable Tool
Top of Casing Elevation 619.03 *
Sampling Method Bailer; sieve

Depth (ft.)	PID Reading	Blow Counts	Recovery (%)	Description/Soil Classification (Color, Texture, Structures)
29.0				
30.0				ML: Silt yellow
31.0				
32.0				
33.0				
34.0				as above
35.0				
36.0				
37.0				
38.0				Silt gray, fine sand
39.0				
40.0				
41.0				Silt gray, v.fine sand
42.0				
43.0				
44.0				
45.0				
46.0				
47.0				SM: Sand brown v.fine silty
48.0				
49.0				
50.0				SP: Sand gray F-CRS gravel well rounded 1"
51.0				
52.0				
53.0				
54.0				
55.0				
56.0				
57.0				
58.0				

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Soil Boring Log

Boring No: T1809

Date: 11/1/88-12/14/88 **Proj. No.:** NA
Client: Eli Lilly
Drilling Company: Layne-Northern
Logged By: Harza Environmental Services, Inc.
Surface Elevation: 618.02 *
Total Depth: 75.0' **Diameter:** 8"
Comments: Northing: 1548.32 Easting: 280.19 (Lilly grid)
* NAD (88) Datum

Project: ELC Tippe Labs Recovery Wells
Location: Lafayette, IN
Driller:
Drilling Method: Rotary, Cable Tool
Top of Casing Elevation 619.03 *
Sampling Method Bailer; sieve

Depth (ft.)	PID Reading	Blow Counts	Recovery (%)	Description/Soil Classification (Color, Texture, Structures)
59.0				
60.0				
61.0				
62.0				
63.0				
64.0				SP: Sand gray f-m
65.0				
66.0				
67.0				
68.0				
69.0				
70.0				CL: Clay gray
71.0				
72.0				
73.0				
74.0				
75.0				EOB 75 FT

Note: Originally a six-inch diameter well was installed to 75' at this location. Later, the well was deepened to 99', with a four-inch screen from 74 to 94'.

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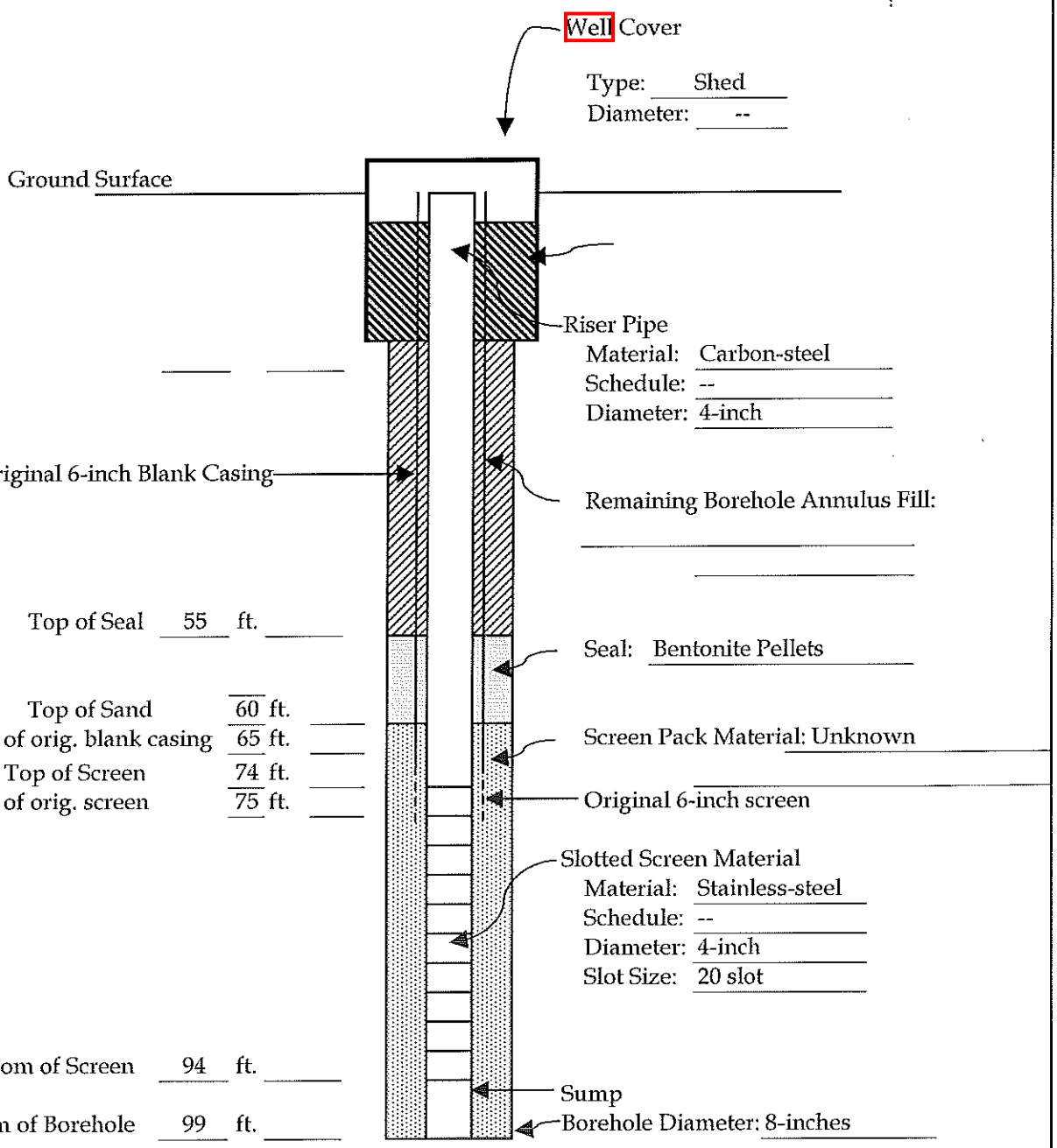
Well Construction Diagram

Well Identification: T1809

Client: Eli Lilly and Company
Project: Recovery Well Installation
Proj. No.: NA
ERM Geologist: NA
Drilling Company: Layne-Northern
Driller: Lewis Melling
Drilling Method: Cable Tool

Date Installed: 12/14/88 and 8/17/92 *
Development Method: Unknown
Water Removed During Development: unknown
Static Water Level Depth/Elevation: unknown
Northing/Easting: 1548.32/280.19
Top of Casing Elevation: 619.03
Ground Elevation: 618.02



Comments: * According to driller, original 6" well to 75' was deepened to 99' and changed to 4".

611
(7
74

T1814

Layne-Northern Company

Division of Layne-Western Company, Inc.

INDIANAPOLIS • MISHAWAKA • LANSING

☐ TEST

☒ PERMANENT

N611.00

Job No. 36-3319

WELL LOG No. 1814 CITY Lafayette County Tippecanoe

Owner Eli Lilly & Company Township Union

Section 36-T23N-R5W

Location State Indiana

From Land Description

From Street or Road

FORMATION FOUND – DESCRIBE FULLY	FROM NATURAL GROUND LEVEL			
	Depth to Top of Stratum	Depth to Bottom of Stratum	Thickness of Stratum	Static Water Level
Brown clay, w/gravel	0'	5'	5'	
Large gravel w/sand fine/med.	5'	16'	11'	
Sand f/m w/small to large gravel	16'	54'	38'	
Fine sand w/small gravel & large boulders	54'	67'	13'	
Clay, brown, silt w/small gravel	67'	79'	12'	
Clay, gray, silty sand	79'	87'	8'	
Sand & Gravel, med. - fine	87'	88'	1'	
Sandy clay	88'	90'	2'	
Gray clay, firm	90'			

67' Unit II upper clay

79' Unit II Sand

90' Unit II 95 ft clay

Hole 16 "Dia Drilled by: { Cable Tool ____ Rotary ____ Jetting ____ / Reverse Circ. ____ Bucket ____ Auger ____ }

Rotary Hole Grouted: Neat Cement ____ Drilling Mud ____ Other ____

Casing 10 "OD From 2' "above ground to 55' feet below ground. Weight ____ Pounds per foot

Screen 10 " Set from 55' / 80' to 67' / 80' feet Make ____ Type SSWW Slot .020

Pumping test ____ GPM drawdown to ____ feet after ____ hours pumping

No. 11 Date Completed 7/23/90 Driller Lewis Melling

T1814

CASING EXTENDS 2 FEET ABOVE GROUND LEVEL

JOB NO. 36-3319

DISTRICT Indianapolis

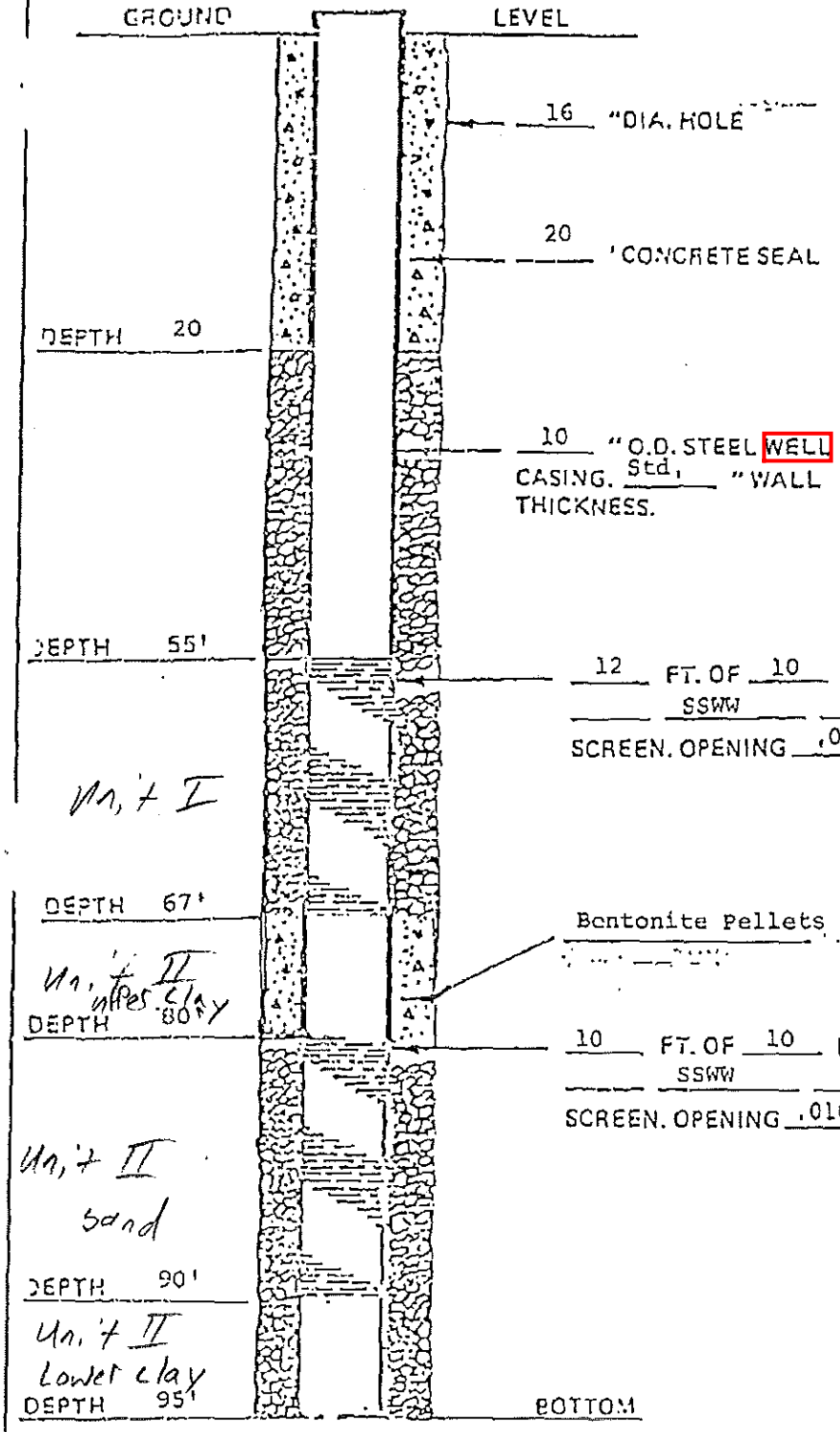
LOCATION

COUNTY Tippecanoe

TOWNSHIP Union

SECTION 36 T 23N R 5W

STATE Indiana



CASING TALLY — WELDED THREADED

	FT.	IN.
BOTTOM		
TOP		
TOTAL		

1814

STATIC LEVEL

PUMPED G.P.M. AT FEET PUMPING LEVEL AFTER HOURS

TYPE OF RIG DRILLER DATE COMPLETED

NOTE: ALL DEPTHS MEASURED FROM GROUND LEVEL. NOT TO SCALE.

ELI LILLY & COMPANY - TIPPECANOE LABS
WELL #1814

LAYNE-NORTHERN

INDIANAPOLIS, IND. MISHAWAKA, IND. LANSING, MICH.

DRAWING NUMBER SC-1

T1815

ERM, Inc.
11350 N. Meridian Street, Suite 220
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(317) 706-2000

Soil Boring Log

Boring No: 1809A
Page 1 of 1

Date: 12/6-12/11/01 **Proj. No.:** 71226.03.01
Client: Eli Lilly and Company
Drilling Company: Reynolds, Inc.
Logged By: Martin Ryan
Surface Elevation: 613.65 (Lilly Datum)
Total Depth: 98 feet **Diameter:** 12-inch ID
Comments: Drillers donned Level C PPE.

Project: Recovery Well Optimization
Location: Tippecanoe Laboratories
Driller: Jeff Jones
Drilling Method: Hollow-Stem Augers
Top of Casing Elevation: 615.68 (Lilly Datum)
Sampling Method: 5-foot continuous sampler

Depth (ft.)	PID Reading	Blow Count	Sample No.	Recovery (%)	Description/Soil Classification (Color, Texture, Structures)
0	NA			Cuttings	0-11' FILL: Clayey gravel, brown, chunk of wood @ 11 ft., wet.
3	NA			Cuttings	
8	0.02			4.5/5	11-30' SC: Gravelly sand, poorly sorted, brown, loose, dry.
13	0.2			3.5/5	
18	0.1			3.5/5	
23	0.4			3.5/5	
28	0.4			4.5/5	
33	42			5/5	30-43' ML: Sandy silt, pale brown, faintly laminated, very friable, solvent odors, dry.
38	48		1809 New (41-41.5')	5/5	UNIT IA - LOESS
43	3.6			5/5	43-68.5' GM: Gravelly sand, brown, poorly sorted, loose, slight odor, moist.
48	3.2			4.5/5	
53	2.2			3.5/5	
58	1.5			3.5/5	
63	0.6			4/5	Black staining, odor, saturated @ 68'.
68	0.1			5/5	68.5-70.5 ML: Silty sand and clay, tan, thinly laminated.
73	3.2			5/5	70.5-78' ML: Silty clay and silt, gray, dense, very stiff, friable. UNIT II - UPPER CLAY TILL
78	8.4			5/5	78-96' SM: Silty sand and sand, gray, graded bedding, saturated, v. strong solvent odor, saturated.
83	6.0			5/5	
88	9.2			5/5	UNIT II - SAND
93	26			5/5	
98					96-98' CL: Silty clay, gray, dense, moist, med. plastic, odor. UNIT II - LOWER CLAY TILL
					EOB 98 feet

T1815

ERM, Inc.
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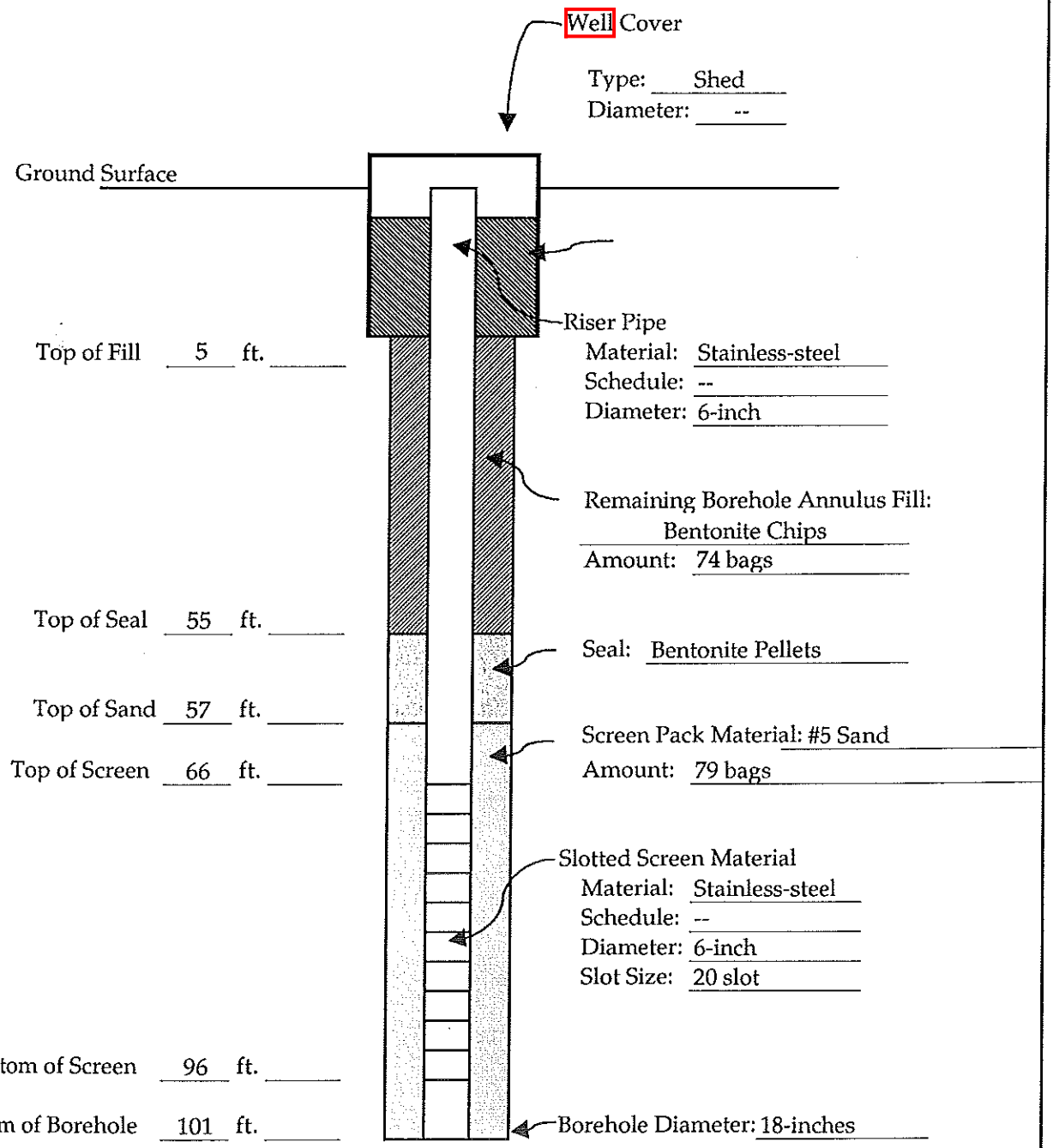
(317) 706-2000

Well Construction Diagram

Well Identification: 1809A

Client: Eli Lilly and Company
Project: Recovery Well Optimization
Proj. No.: 71226.03.01
ERM Geologist: Martin Ryan
Drilling Company: Reynolds, Inc.
Driller: Jeff Jones
Drilling Method: Hollow-Stem Augers

Date Installed: 12/11/02
Development Method: Submersible Pump
Water Removed During Development: >200 gal.
Static Water Level Depth/Elevation: 69.41 (1/25/02)
Northing/Easting: 1546.9613/292.2406
Top of Casing Elevation: 615.68 (Lilly Datum)
Ground Elevation: 613.65 (Lilly Datum)



Comments: Sump from 96 to 101'. Water has very strong solvent odor.

T1818

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Carmel, Indiana 46032
(317) 706-2000

Soil Boring Log

Boring No: VEW1
Page 1 of 1

Date: 7/9-7/10/03 **Proj. No.:** 0008469
Client: Eli Lilly and Company
Drilling Company: Reynolds, Inc.
Logged By: Martin Ryan
Surface Elevation: ~ 615
Total Depth: 85' **Diameter:** 12.25-inch ID
Comments: Boring drilled to 98', well set at 85'.

Project: Vapor Extraction Well
Location: Tippecanoe Laboratories
Driller: Jeff Jones
Drilling Method: Hollow-Stem Augers
Top of Casing Elevation:
Sampling Method: 5-foot continuous sampler

Depth (ft.)	PID Reading	Blow Count	Sample No.	Recovery		Description/Soil Classification (Color, Texture, Structures)
0				Cuttings	0-12'	Gravelly Sandy Clay Fill, solvent odor beginning @ 6', Dark yellowish brown 10YR 4/4.
3				Cuttings		
8	1.0			2.5/5		
13	1.6			1/5		
18	3.2			2.5/5	12-30.5'	Gravelly Sand, loose, poorly sorted, gravel subround, dry to moist with depth, dark yellowish brown 10YR 4/4.
23	1.6			1/5		
28	2.6			4/5		
33	0.0			4.5/5	30.5-45'	Silty Sand, very fine, well sorted, laminated/cross bedding <1", coarsening fine sand from 40-45', strong solvent odor, light olive brown 2.5Y 4/4. Unit IA Silt
38	89			5/5		
43	67			5/5		
48	54			5/5	45-66'	Fine Sand to Coarse Sand w/depth, moderately sorted, loose, solvent odor, increasing gravel up to 5%, dry to v. moist w/depth, gray 5Y 5/1.
53	39			4/5		
58				4/5		
63	7.7			5/5		
68	5.5			3.5/5	66'-78'	Sandy Clay, v. fine sand lense from 68-71', saturated @ 69', moderate solvent odor, coarse grained sand, cohesive, dark grey 10YR 4/1.
73	325			4/5		
78	120				78-98'	Clay Till, hard, trace coarse sand, dry-moist, trace cobbles, dark grayish brown 2.5Y 3/2.
83				5/5		
88						
93				5/5		
98						End of Boring @ 98' (Well set @ 85')

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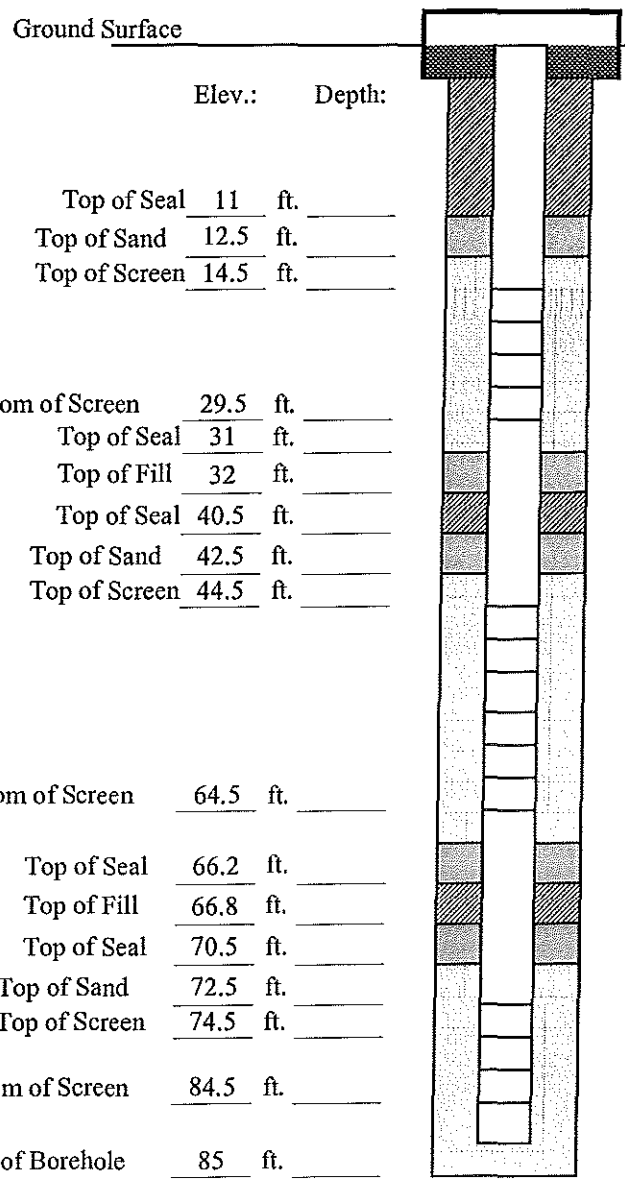
Well Construction Diagram

T/8/8

Well Identification: VEW1

Client:	Eli Lilly	**Date Installed:**	7/11/03
Project:	SVE Pilot Testing	**Date Developed:**	
Proj. No.:	0004213	**Development Method:**	
ERM Geologist	Andy Wallace	**Water Removed During Development:**	
Drilling Company:	Reynolds, Inc.	**Static Water Level Depth/Elevation:**	
Driller:	Jeff Jones	**Top of Casing Elevation:**	
Drilling Method:	18.25" HSA	**Ground Elevation:**	



	Elev.:	Depth:	
Top of Seal	11	ft.	Borehole Annulus Fill: 115 gal. Barotherm Grout
Top of Sand	12.5	ft.	Seal: 10 gal. 3/8" Bentonite Pellets
Top of Screen	14.5	ft.	Slotted Screen Material 12.5 bags #5 Sand
			Material: Stainless Steel
			Schedule:
			Diameter: 6"
Bottom of Screen	29.5	ft.	Slot Size #20
Top of Seal	31	ft.	Seal: 10 gal. 3/8" Bentonite Chips
Top of Fill	32	ft.	Borehole Annulus Fill: 110 gal. Barotherm Grou
Top of Seal	40.5	ft.	Seal: 30 gal. 3/8" Bentonite Pellets
Top of Sand	42.5	ft.	Slotted Screen Material 74 bags #5 Sand
Top of Screen	44.5	ft.	Material: Stainless Steel
			Schedule:
			Diameter: 6"
Bottom of Screen	64.5	ft.	Slot Size #20
Top of Seal	66.2	ft.	Seal: 3 bags 3/8" Bentonite Chips
Top of Fill	66.8	ft.	Borehole Annulus Fill: 46 gal. Barotherm Grout
Top of Seal	70.5	ft.	Seal: 10 gal. 3/8" Bentonite Pellets
Top of Sand	72.5	ft.	Slotted Screen Material 15 bags #5 Sand
Top of Screen	74.5	ft.	Material: Stainless Steel
			Schedule:
			Diameter: 6"
Bottom of Screen	84.5	ft.	Slot Size: #20
Bottom of Borehole	85	ft.	Borehole Diameter 18.25"

T1819

ERM, Inc.
11350 N. Meridian Street, Suite 220
Carmel, Indiana 46032
(317) 706-2000

T1819

Soil Boring Log

Boring No: VEW2

Date: 7/22/03 Proj. No.: 0008469
Client: Eli Lilly and Company
Drilling Company: Reynolds, Inc.
Logged By: Martin Ryan
Surface Elevation:
Total Depth: 85' Diameter: 12.25-inch ID
Comments: Boring drilled to 98', well set at 89'.

Project: Vapor Extraction Well
Location: Tippecanoe Laboratories
Driller: Chris Boulet
Drilling Method: Hollow-Stem Augers
Top of Casing Elevation:
Sampling Method: 5-foot continuous sampler

Depth (ft.)	PID Reading	Blow Count	Sample No.	Recovery	Description/Soil Classification (Color, Texture, Structures)
0					
3				Cuttings	0-15' Gravelly Clay Fill, no odor, no stains, brown 10YR 4/3.
8				Cuttings	
13	56.7			3/5	
18	81.4			2.5/5	
23	66.7			3/5	15-18' Gravelly Sand, loose, poorly sorted, subrounded gravel up to 2", slight colvent odor, dark yellowish brown 10YR 3/4.
28	50.3			2.5/5	
33	33.0			3/5	18-25' Sand, well sorted, loose, moist, gravel present up to 1", no odor, brown 10YR 4/3.
38	40.0			2.5/5	25-51' Gravelly Sand, loose, poorly sorted, subrounded gravel up to 2", moderate solvent odor from 48-51', dark yellowish brown 10YR 3/4.
43	70.0			4/5	
48	96.0			2.5/5	
53	92.0			4/5	
58	125			4/5	51-61' Silty Sand, dry, strong solvent odor, well sorted, faintly laminated, grey 10YR 7/2. Unit IA Sand
63	429			4/5	
68	3329			3/5	
73	191			3/5	61-82' Gravelly Sand, loose, poorly sorted, subround gravel up to 2", strong solvent odor, grey staining from 65-68, saturated @ 63', brown 10YR 4/3.
78	43			3.5/5	
83				4/5	
88				3/5	82-94' Silty Sand, well sorted, moderate odor, black staining throughout, black 5Y 2.5/1. Unit II Sand
93				1/5	
				5/5	94-98' Clay Till, hard, trace sand throughout, dry, no odor, no staining, very dark greyish brown 2.5Y 3/2.
98					Unit II Lower Clay
					End of boring @ 98.0'

T1819

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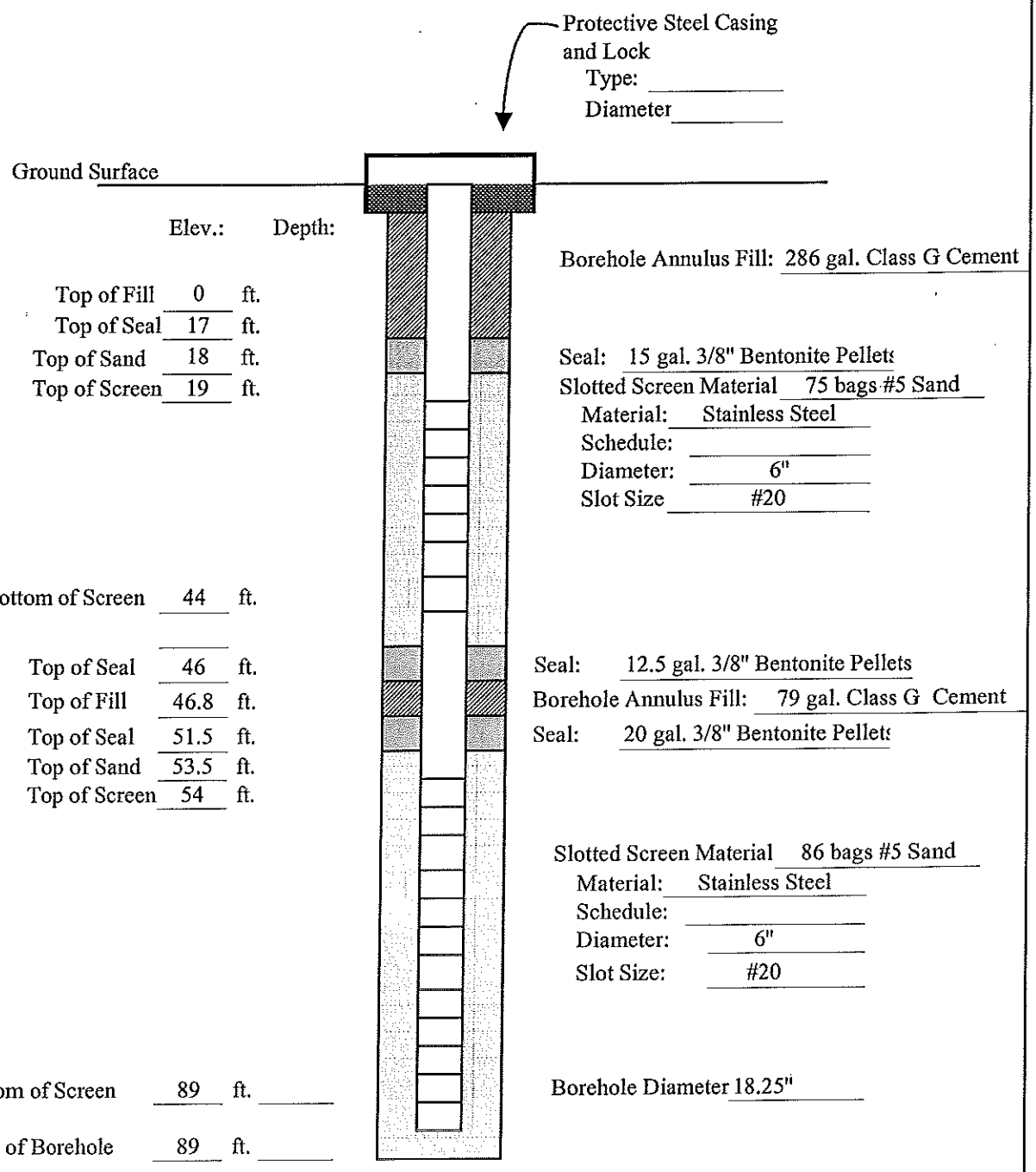
(317) 706-2000

Well Construction Diagram

T1819

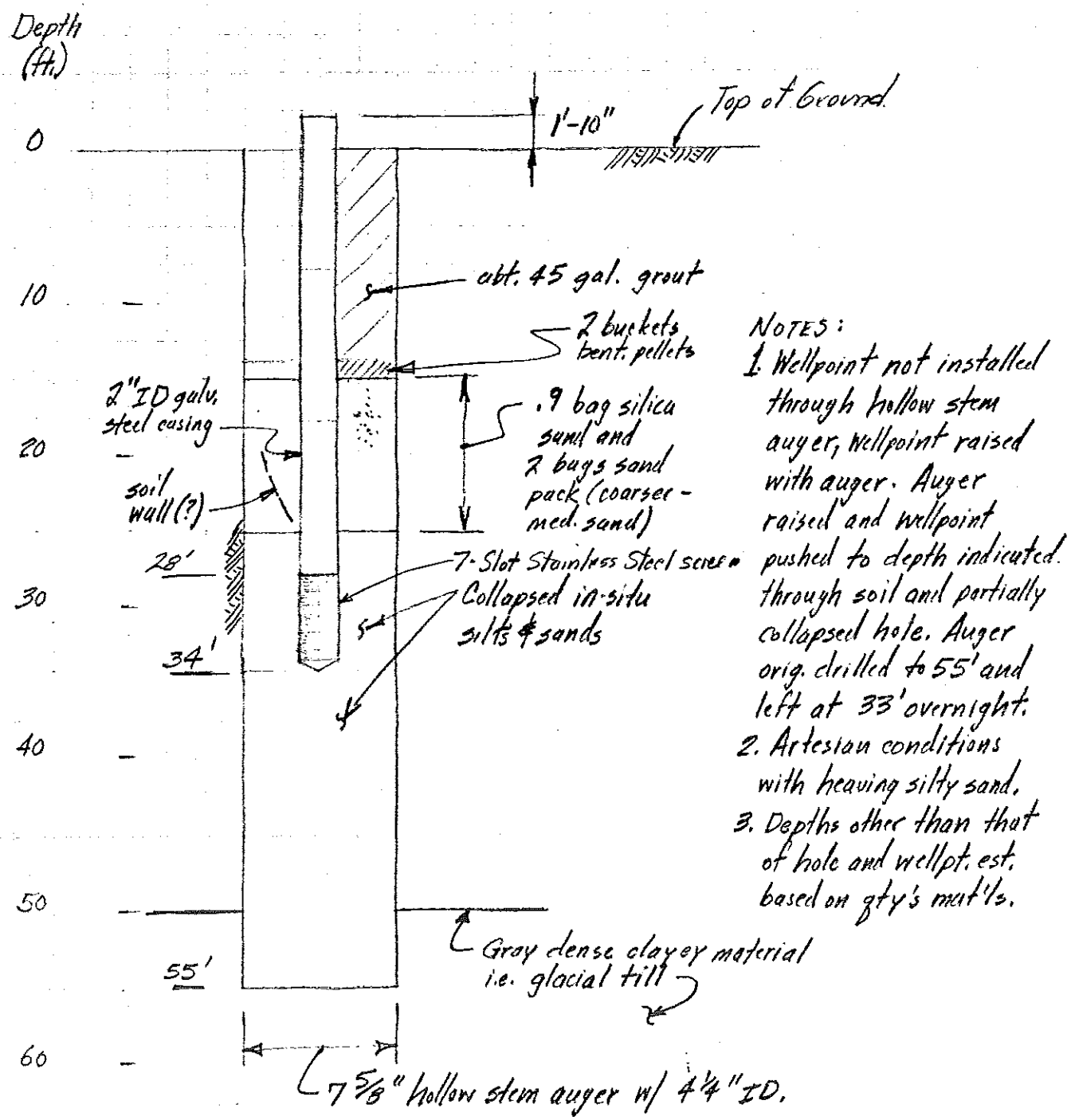
Well Identification: VEW2

Client:	Eli Lilly	**Date Installed:**	7/30/03
Project:	SVE Pilot Testing	**Date Developed:**	
Proj. No.:	0004213	**Development Method:**	
ERM Geologist	Andy Wallace	**Water Removed During Development:**	
Drilling Company:	Reynolds, Inc.	**Static Water Level Depth/Elevation:**	
Driller:	Chris Boulet	**Top of Casing Elevation:**	
Drilling Method:	18.25" HSA	**Ground Elevation:**	



T1822

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Construction Sketch MW-B = T1822	PROJECT Lafayette
	COMPUTED A.J. Franc CHECKED	FILE NO. 1684
		DATE 2/2/85 PAGE 2 OF 2 PAGES



NOTES:
1. Wellpoint not installed through hollow stem auger, wellpoint raised with auger. Auger raised and wellpoint pushed to depth indicated through soil and partially collapsed hole. Auger orig. drilled to 55' and left at 33' overnight.
2. Artesian conditions with heaving silty sand.
3. Depths other than that of hole and wellpt. est. based on qty's mat'ls.

Note: Bailed 3 bailers full, water did not appear to contain cement bentonite grout, after grout placed.

HARZA ENGINEERING COMPANY

Sheet 1 of 1

SOIL BORING LOG

T1831

Project Name ELC-PHASE C

Project Number 1684

Client ELC

Contractor TSC

Drilling Method HS w/ PLUG

Hole Size 7"

Driller GLENN

Logged by RLJ

River EL ~516, -3'; EL. 501, -18'

WATER LEVEL	-2', -24'	-5'	-15.69
TIME	DURING	AFTER	DEVEL'D WELL
DATE	11/20	11/20	1/20/86

Sample Hammer: Weight 140#

Drop 30"

Sampler Dimensions SPT

Boring No. ~~FP-11 (MW-M)~~

Location 35' N TOW PATH, 175' AER POND

Coordinates: N 20+51

E 03+95

Ground Elevation 518.8

Total Depth 30 FT.

Date Started 11/20/85 PARTLY CLOUDY & COLD

Date Completed 11/20/85

Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Sampler Type	Blows per 6 in/15cm	Length Driven (in/cm)	Length Recovered (in/cm)	Casing Depth (ft/m)	Unified Soil Classification FIELD	SOIL DESCRIPTION	NOTES AND FIELD TESTS
									Surface Conditions: BENCH BETWEEN SLUDGE PONDS.	
									FILL: BROWN SAND & GRAVEL w/ CLAY BINDER	PERCHED WATER 2-4½ FT.
	3½			1						"SATURATED"
	-			1						
5	5	S1	SS	1	18"	8"	-	OL	VERY SOFT GRAY SILTY CLAY LITTLE ORGANIC	"VERY MOIST" STRONG DECAYED VEGETATION ODOR.
	8½			1					?	
	-			1	1ST	0	¼ TRAP		VERY LOOSE GRAY TO BLACK CLAYEY FN-MD SAND	"VERY MOIST"
10	10	S2	SS	1	18"	2ND 3"	-	SC	LITTLE ORGANIC	STRONG ODOR
	13½			0					VERY SOFT GRAY TO BLACK SILTY CLAY LITTLE ORGANIC, MATTER OCCASIONAL SAND SEAMS	"VERY MOIST" ODOR DIMINISHES WITH DEPTH
	-			0						
15	15	S3	SS	1	18"	18"	-	OL		WATER IS FOAMING ON RODS.
	18½			2					SOFT GRAY SILTY CLAY LITTLE SAND TO GRAVELS IN SEAMS LITTLE ORGANIC MATTER	"MOIST"
	-			2	1ST	0	¼ TRAP			S4, 2ND ATTEMPT TO -21'
20	20	S4	SS	2	18"	2ND 7/8"	-	OL		MODERATE ODOR
	23½			0					SAME	▽ "MOIST" 24'
	-			0						
25	25	S5	SS	4	18"	18"	-	SP-SM	LOOSE GRAY TO BLACK SILTY FN-CRS SAND TRACE ORGANIC OCCASIONAL GRAVEL	"SATURATED" SLIGHT SOLVENT ODOR MODERATE VEG. ODOR
	28½			W					VERY LOOSE LT. GRAY SILTY FN. SAND	"SATURATED"
	-			0						MODERATE ODOR
30	30	S6	SS	R	18"	18'	-	SM		S6 DRIVEN TO -31', OVERSAMPLED
				7					EOB -30'	
				9						

3" WELL PT. : 23-28'
CAVE : 30-24'
GRAVEL PACK : 24-21'
SEAL : 21-18'
ELEV. TOC : 520.87

WELL DATA

HOLE GROUTED ABOVE SEAL.

HARZA ENGINEERING COMPANY

Page ____

T1831

BORING/WELL COMPLETION REPORT
PROJECT: Phase C, Tippecanoe Laboratories

BORING/WELL NO: MW-M (FP-11) = T1831

Date Installed/Completed: 11 / 20 / '85

Contractor: TSC

General Location: Floodplain

Coordinates: North 20+51
East 03+95

Top Elevations: Ground 518.8 T.O.C.: 520.87

Bottom Elevations: Boring: 488.8 Well: 490.87 Seal: 498-501

Drilled Diameter: 7 "
Drilled Depth: 30'

Drilling Method: Hollow Stem w/plug
Drilling Fluid: "Revert" during well installation only

Cased/Screened: Yes X No __

Casing Type Galvanized steel Diam. 3" From -23 To 2.0 stick-up
Screen Type 10-slot Stainless steel Diam. 3" From -23 To 28'

Other Materials Installed (Type, Size, Depth):
5' surface protective casing, 6" square steel to -2½', set in grout.

Gravel Packed: Yes X No __ Materials Pea gravel
Grouted: Yes X No __ Materials Cement-bentonite
Backfilled: Yes X No __ Materials Cave; silty sand

Geologic/Soil Log Available: Yes X No __
Field Permeability Tests Available: Yes __ No __ Type ____
Static Water Level: TOC Depth 15.69' Date 1 / 20 / '86

Formations Passed Through	Depth From	Depth To	Elev. From	Elev. To	Thickness
Fill	0	4	518.8	514.8	4'
Unit IV (Alluvials)	4	30	514.8	488.8	> 26'

Remarks:
Groundwater had slight solvent odor.
Well point set in a silty sand.

(Attach Well Construction Sketch)

Engineer/Inspector: R L Johnson Date: 1/'86

HARZA ENGINEERING COMPANY

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T1831

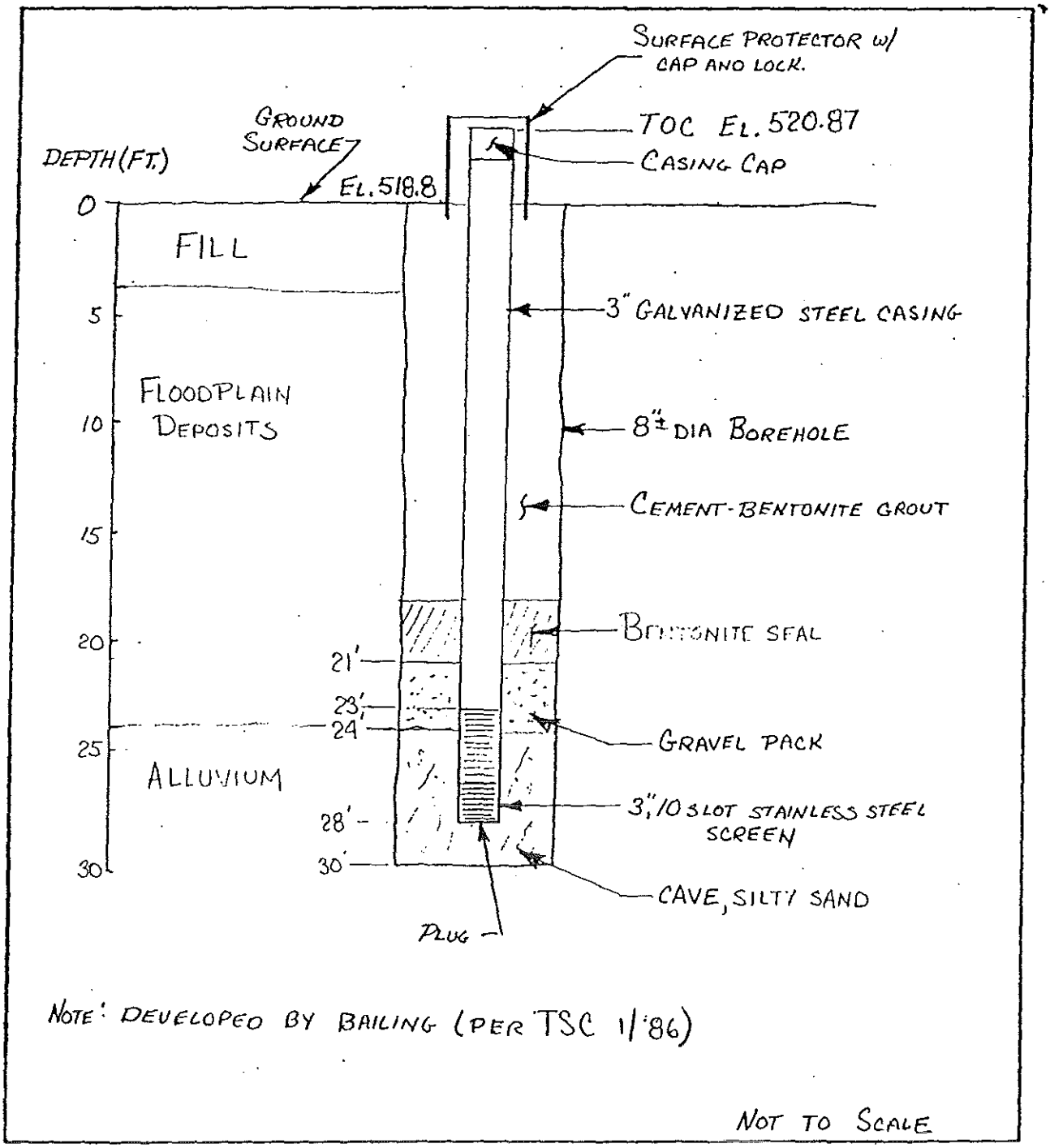
WELL CONSTRUCTION SKETCH

PROJECT: Phase C, Tippecanoe Laboratories

WELL NUMBER: MW-M = T1831

COORDINATES: North 20+51
East 03+95

ELEVATIONS: Ground 518.8
T.O.C. 520.87



NOTE: DEVELOPED BY BAILING (PER TSC 1/'86)

NOT TO SCALE

Engineer/Inspector: R L Johnson Date: 1/86

HARZA ENGINEERING COMPANY

Sheet 1 of 1

SOIL BORING LOG

T1832

Project Name ELC - PHASE C

Project Number 1684

Client ELC

Contractor TSC

Drilling Method HS w/PLUG

Hole Size 7"

Driller GLENN

Logged by RLJ

RIVER EL. ~517, -10'; EL 501, -26'

WATER LEVEL	-11'	-10'	12:72
TIME	DURING	AFTER	DEVEL'O WELL
DATE	11/21	11/21	1/20/86

Sample Hammer: Weight 140#

Drop 30"

Sampler Dimensions SPT

Boring No. FP-13 (MW-0)

Location 8'N TOW PATH; 20'E AER. POND

Coordinates: N 20+13

E 02+15

Ground Elevation 526.6

Total Depth 30 FT.

Date Started 11/21/85 CLEVELAND CLIFFS

Date Completed 11/21/85

Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Sampler Type	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Casing Depth (ft/m)	Unified Soil Classification FIELD	SOIL DESCRIPTION	NOTES AND FIELD TESTS
									Surface Conditions: SHOULDER OF TOW PATH ROAD	
									FILL: BROWN SAND AND GRAVEL w/ CLAY BINDER & BROWN CLAY LAYERS.	"MOIST"
	3½			4						
	-	S1A		3						
5	5	S1B	SS	2	18"	14"	-	OL	SOFT GRAY SILTY CLAY TRACE ORGANIC TRACE SAND	"MOIST"
	8½			1					SOFT GRAY TO BLACK SILTY CLAY LITTLE ORGANIC	"MOIST" SLIGHT DECAY VEGETATION ODOR. ▽-11'
	-			5						
10	10	S2	SS	6	18"	13"	-	OL		
	13½			4					LOOSE BLACK SILTY FN-CRS SAND LITTLE ORGANIC & PC. WOOD	"SATURATED" MODERATE ODORS
	-			4	1ST	0"		SP-		
15	15	S3	SS	4	18"	2ND 0"	-	OL		
	18½			2					SOFT BLACK SILTY CLAY LITTLE FN. SAND TRACE ORGANIC OCCASIONAL CRS SAND & SM. GRAVEL LAYER	"SATURATED" MODERATE SOLVENT OC
	-			1						COLLECT WATER SAM FP-13; A, B & C AFTER S4, W.L.@-10'.
20	20	S4	SS	1	18"	11"	-	OL		
	23½			3					STIFF LT. GRAY SILTY CLAY LITTLE SANDS	"VERY MOIST" MODERATE SOLVENT OD
	-			3				CL-		
25	25	S5	SS	5	18"	11"	-	SC		
	28½			4					TOUGH GRAY SILTY CLAY LITTLE SANDS (TILL)	"MOIST"
	-			6						
30	30	S6	SS	8	18"	15"	-	CL	EOB - 30'	

3" WELL PT.: 18-13'
CAVE: NONE
GRAVEL PACK: 30-10'
SEAL: 10-7'
ELEVATION TOC: 528.69

WELL DATA

HOLE GROUTED ABOVE SEAL.

HARZA ENGINEERING COMPANY

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T1832

BORING/WELL COMPLETION REPORT
PROJECT: Phase C, Tippecanoe Laboratories

BORING/WELL NO: MW-0 (FP-13) = T1832

Date Installed/Completed: 11 / 21 / 85

Contractor: TSC

General Location: FLOODPLAIN

Coordinates: North 20+13
East 02+15

Top Elevations: Ground 526.6 T.O.C.: 528.69

Bottom Elevations: Boring: 496.6 Well: 508.7 Seal: 516-519

Drilled Diameter: 7"
Drilled Depth: 30'

Drilling Method: HOLLOW STEM w/ PLUG
Drilling Fluid: "REVERT" DURING WELL INSTALLATION

Cased/Screened: Yes X No ___

Casing Type GALVANIZED STEEL Diam. 3" From -13' To 2' STICKUP
Screen Type 10-SLOT STAINLESS STEEL Diam. 3" From -18' To -13'

Other Materials Installed (Type, Size, Depth):
5-FT. SURFACE PROTECTIVE CASING, 6" SQUARE STEEL TO -2½', SET IN GROUT

Gravel Packed: Yes X No ___ Materials PEA GRAVEL
Grouted: Yes X No ___ Materials CEMENT-BENTONITE
Backfilled: Yes ___ No X Materials ___

Geologic/Soil Log Available: Yes X No ___
Field Permeability Tests Available: Yes ___ No ___ Type ___
Static Water Level: TOC Depth 12.72 Date 1 / 20 / 86

Formations Passed Through	Depth From	Depth To	Elev. From	Elev. To	Thickness
FILL	0	4	526.6	522.6	4'
UNIT IV (ALLUVIALS)	4	22.5	522.6	504.1	18.5'
UNIT II (TILL)	22.5	25'	504.1	501.6	> 2.5'

Remarks:
POOR SAND LAYER (THIN AND SILTY) WAS IMPROVED BY PLACING GRAVEL BELOW WELL POINT.
GROUNDWATER HAD SLIGHT SOLVENT ODOR

(Attach Well Construction Sketch)

Engineer/Inspector: R L Johnson Date: 1/'86

HARZA ENGINEERING COMPANY

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T1832

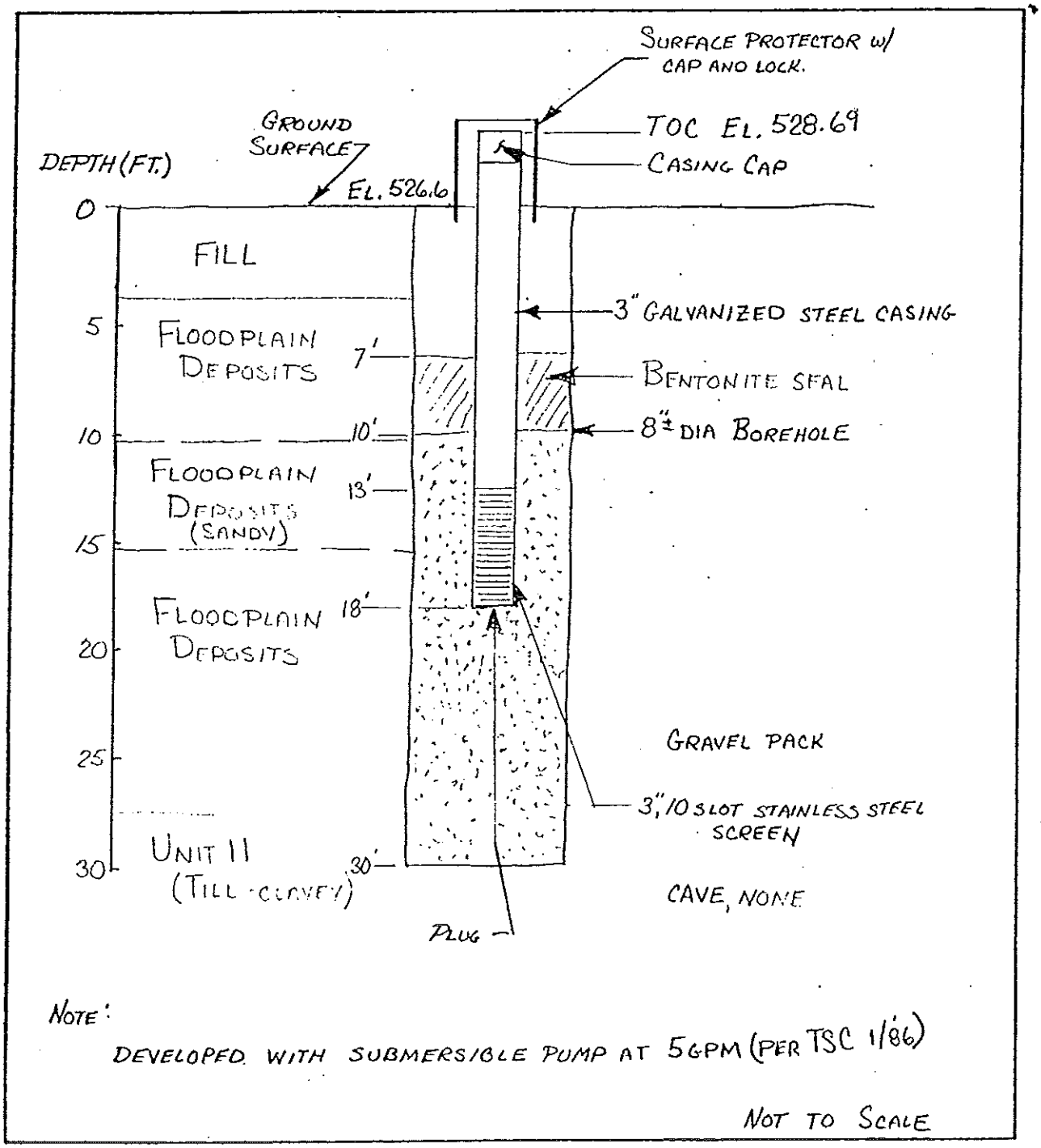
WELL CONSTRUCTION SKETCH

PROJECT: Phase C, Tippecanoe Laboratories

WELL NUMBER: MW-0 = T1832

COORDINATES: North 20+18
East 02+15

ELEVATIONS: Ground 526.6
T.O.C. 528.69



NOTE:

DEVELOPED WITH SUBMERSIBLE PUMP AT 5GPM (PER TSC 1/86)

NOT TO SCALE

Engineer/Inspector: R L Johnson Date: 1/'86

HARZA ENGINEERING COMPANY

Sheet 2 of 2

SOIL BORING LOG

T1833

Project Number 1684
Client ELC
Contractor TSC
Drilling Method HSA w/Plug & Revert Mud
Hole Size 7"
Driller GLENN
Logged by RW

Project Name ELC - PHASE C
River El. ~517' + 5' El. 501, -11'

WATER LEVEL	FP-14 -5	+2'	9.76
TIME	DURING	AFTER	DEVEL'D WELL
DATE	11/22	11/22	11/26/86

Sample Hammer: Weight NA
Drop NA
Sampler Dimensions NA

Boring No. MW-P (SEE FP-14)
Location 8' W of FP-14
Coordinates: N 21+31
E 05+23
Ground Elevation 512.4
Total Depth 19 FT.
Date Started 11/22/85 Cloudy cool
Date Completed 11/22/85

Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Sampler Type	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Casing Depth (ft/m)	Unified Soil Classification	SOIL DESCRIPTION	NOTES AND FIELD TESTS
									Surface Conditions: FLOOD OF OLD SLUDGE POND; WEEDS & REEDS	
									SEE FP-14 LOG FOR SOIL DESCRIPTION	
									NO SAMPLING	
5										
10										
15										
20									EOB -19'	HOLE HELD OPEN TO -10' BY REVERT AFTER PULLING AUGERS. (SAND ON LEAD AUGER.)
										PUSH WELL EASILY TO -18'.
										ARTESIAN FLOW DEVELOPS UPON FLUSHING REVERT FROM HOLE.
									3" WELL POINT: 18-13'	WELL DATA
									CAVE: 19-14'	
									GRAVEL PACK: 14-8'	
									SEAL: 8-5'	
									ELEVATION TOC: 514.45	HOLE GROUTED ABOVE SEAL.

SOIL BORING LOG

Project Number 1684
Client ELC
Contractor TSC
Drilling Method HS w/PLUG
Hole Size 7"
Driller GLENN
Logged by RLJ

Project Name ELC-PHASE C
RIVER EL. ~517 +5'; MW-P EL501.-11'

WATER LEVEL	-5'	(+2')	9.76
TIME	DURING	AFTER	DEVEL'D WELL
DATE	11/22	11/22	1/20/86

Sample Hammer: Weight 140#
Drop 30"
Sampler Dimensions SPT

Boring No. FP-14 SEE MW-P
Location 100'N Tow Pann, 350'E Apr. Pw-
Coordinates: N 21+31
E 05+31
Ground Elevation 512.4
Total Depth 18.5 FT.
Date Started 11/22/85 CLOUDY COOL
Date Completed 11/22/85

Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Sampler Type	Blows per 6 in/15cm	Length Driven (in/cm)	Length Recovered (in/cm)	Casing Depth (ft/m)	Unified Soil Classification Field
	3½			2				
	-			2				
5	5	S1	SS	1	18"	12"	—	OL
	8½			(3)				
	-			(2)	1ST	0		
10	10	S2	SS	(2)	18"	2ND 2 LAYS	—	SM
	13½			2				
	-			4				
15	15	S3	SS	6	18"	14"	—	SP
	18½	S4	SS	-	-	6"	-	SP
20								

SOIL DESCRIPTION

Surface Conditions: OLD SLUDGE POND FLOOR; DENSE WEEDS/REEDS.

SOFT BROWN & GRAY SILTY CLAY
LITTLE SANDS & SEAMS

LOOSE GRAY CLAYEY SILT
LITTLE FN SAND
TRACE ORGANIC

LOOSE GRAY TO BLACK MD-CRS SAND AND SM GRAVEL (VARIABLE COLOR, SUBROUNDED) AND FN-MD SAND LAYERS
TRACE ORGANIC (MARL)

EOB -18½'

NOTES AND FIELD TESTS

"VERY MOIST"
MODERATE DECAY VEGETATION ODOR.
▽ -5'
"SATURATED"
S2 IS SAMPLE OF BLOW-UP MATERIAL IN HS ANNULUS; NOTE THAT PLUG UTILIZED DURING DRILLING.
WHEN PLUG WAS PULLED FOR S4 BLOW-UP WAS TO -10'. S4 FROM HS.
UNABLE TO SAMPLE.
UNABLE TO ADVANCE AUGER.
HOLE COLLAPSED.

HARZA ENGINEERING COMPANY

Page
T1833

BORING/WELL COMPLETION REPORT
PROJECT: Phase C, Tippecanoe Laboratories

BORING/WELL NO: MW-P (FP-14) = T1833

Date Installed/Completed: 11 / 22 / '85

Contractor: TSC

General Location: FLOODPLAIN

Coordinates: North 21+31
East 05+23

Top Elevations: Ground 512.4 T.O.C.: 514.45

Bottom Elevations: Boring: 493.4 Well: 496.45 Seal: 504-507

Drilled Diameter: 7 "
Drilled Depth: 19'
Drilling Method: HOLLOW STEM w/PLUG
Drilling Fluid: "REVERT"

Cased/Screened: Yes X No

Casing Type GALVANIZED STEEL Diam. 3" From +13' To 2' STICKUP.
Screen Type 10-SHOT STAINLESS STEEL Diam. 3" From +18' To +13'

Other Materials Installed (Type, Size, Depth):
5 FT SURFACE PROTECTIVE CASING, 6" SQUARE STEEL TO +2½', SET IN GROUT

Gravel Packed: Yes X No Materials PEA GRAVEL
Grouted: Yes X No Materials CEMENT-BENTONITE - PEA GRAVEL
Backfilled: Yes X No Materials CAVE, ORGANIC SAND

Geologic/Soil Log Available: Yes X No
Field Permeability Tests Available: Yes No Type
Static Water Level: TOC Depth 9.76 Date 1 / 20 / '86

Formations Passed Through	Depth From	Depth To	Elev. From	Elev. To	Thickness
UNIT IV (ALLUVIALS)	0	19	512.4	493.4	> 19'

Remarks:
SOIL WAS SAMPLED BY BOREHOLE 8' E OF MW-P; EXCESSIVE "BLOW UP" INTO HS ANNULUS.
ARTESIAN FLOW STARTED DURING WELL INSTALLATION, AND WAS TO TOP OF CASING (+2') UPON COMPLETION. RIVER ELEVATION RISING AT ~.20 DURING INSTALLATION

(Attach Well Construction Sketch)

Engineer/Inspector: R L Johnson Date: 1/'86

HARZA ENGINEERING COMPANY

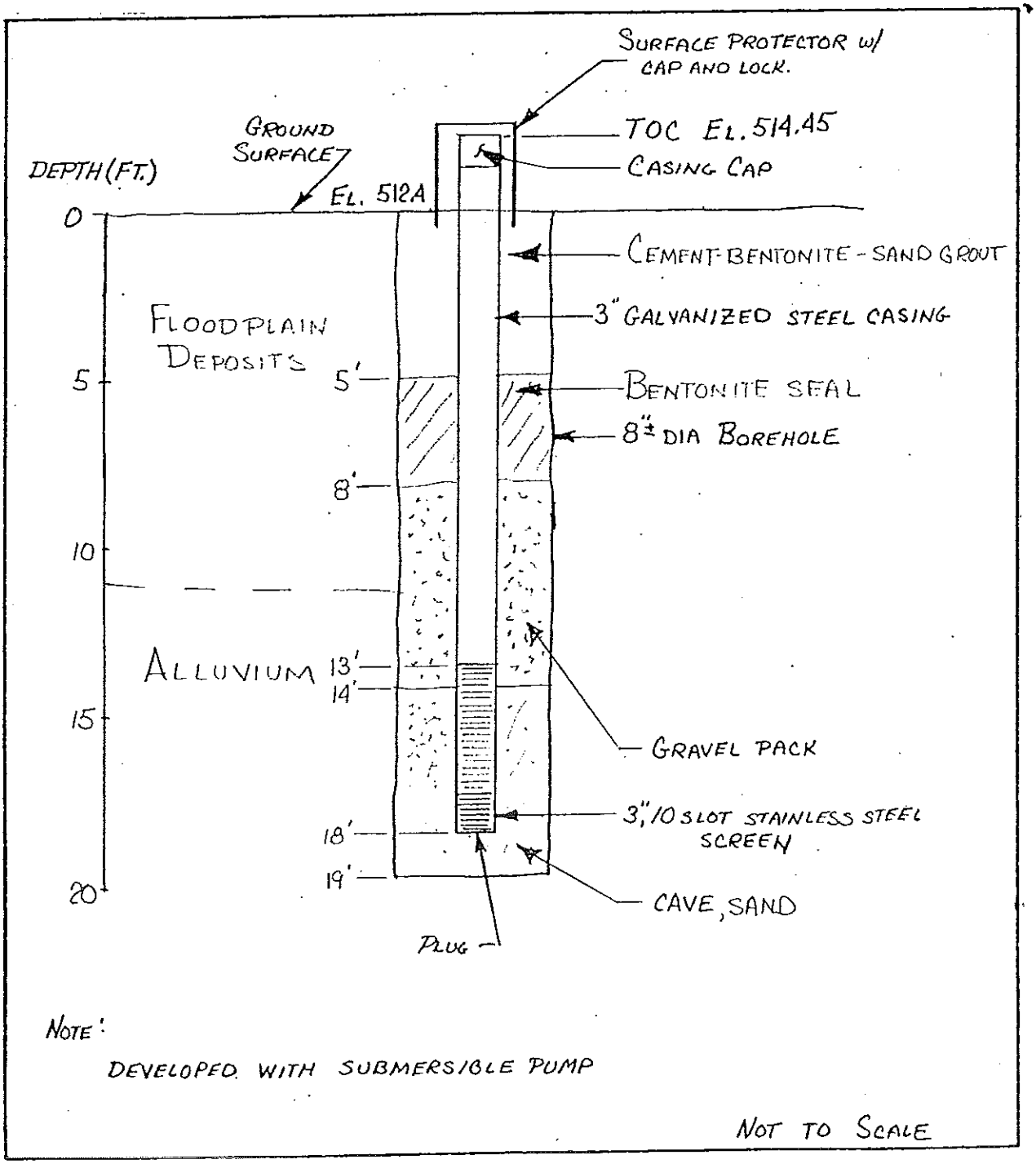
Page __
T1833

WELL CONSTRUCTION SKETCH
PROJECT: Phase C, Tippecanoe Laboratories

WELL NUMBER: MW-P = T1833

COORDINATES: North 21+31
East 05+23

ELEVATIONS: Ground 512.4
T.O.C. 514.45



NOTE:
DEVELOPED WITH SUBMERSIBLE PUMP

NOT TO SCALE

Engineer/Inspector: R L Johnson Date: 1/'86

HARZA ENGINEERING COMPANY

Sheet 1 of 1

SOIL BORING LOG

T1834

Project Name ELC - PHASE C

Project Number 1684

Client ELC

Contractor TSC

Drilling Method HS w/PLUG

Hole Size 7"

Driller GLENN

Logged by RLJ

River El. ~517. -1'; EL501.17'

WATER LEVEL	-3, -22'	-5	-15.50
TIME	DURING	AFTER	DEVELO WELL
DATE	11/21	11/21	1/20/86

Sample Hammer: Weight 140#

Drop 30"

Sampler Dimensions SPT

Boring No. ~~FP-12 (MW-N)~~

Location 100'N TOWPATH; 120'E ARR. P.

Coordinates: N 21+22

E 03+09

Ground Elevation 517.7

Total Depth 90 FT.

Date Started 11/21/85 (Muddy Core)

Date Completed 11/21/85

Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Sampler Type	Blows per 6 in/15cm	Length Driven (in/cm)	Length Recovered (in/cm)	Casing Depth (ft/m)	Unified Soil Classification FIELD	SOIL DESCRIPTION	NOTES AND FIELD TESTS
									Surface Conditions: BENCH BETWEEN SLUDGE PONDS; WEEDS.	
									FILL: BROWN SAND & GRAVEL w/CLAY BINDER	"MOIST"
	3½			1						SPOILS HAVE STRONG DECAY VEG. ODOR.
	-			1						PERCHED WATER @ -3'
5	5	S1	SS	1	18"	3"	-	-	SOFT GRAY SILTY CLAY LITTLE ORGANIC & LAYERS TRACE TO LITTLE FN SAND & SEAMS	"MOIST" MODERATE DECAY VEGETATION ODOR.
	8½			1						
	-			1						
10	10	S2	SS	2	18"	18"	-	OL		
	13½			1					SOFT GRAY SILTY CLAY TRACE ORGANIC w/MARL LITTLE FN. SAND & SEAMS	"MOIST" SLIGHT DECAY VEGETATION ODOR.
	-			1						
15	15	S3	SS	2	18"	18"	-	OL		
	16½			1					SOFT GRAY FN SANDY SILTY CLAY TRACE ORGANIC w/MARL	"MOIST" SLIGHT DECAY VEGETATION ODOR
	-			1						
20	20	S4	SS	1	18"	18"	-	OL		
										▽ -22' I ROSE QUICKLY TO -5, ABOVE RIVER LEVEL
	23½			(3)					LOOSE GRAY MD TO CRS SAND TRACE SILT TO FN SAND COARSER MATERIAL SUBROUNDED, VARIABLE COLOR	"SATURATED" SLIGHT SOLVENT ODOR
	-			(5)						5 FT. BLOW-UP HS, LIFT AUGER STRING AND SAND FALLS OUT; S5 OVERSAMPLED
25	25	S5	SS	(8)	18"	16"	-	SP		
	28½			6						
	-			7					SAME	"SATURATED"
30	30	S6	SS	-	12"	12"	-	SP		S6, DRIVEN TO 29½' ONLY TO AVOID OVERSAMPLING.
									EOB -30'	COLLECT WATER SAMPLES FP12; A, B & C
									3" WELL PT.: 22½-27½' CAVE: 24-30' GRAVEL PACK: 24-21' SEAL: 21-18' ELEVATION TOC: 520.21	WELL DATA HOLE GROUTED ABOVE SEAL.

HARZA ENGINEERING COMPANY

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T1834

BORING/WELL COMPLETION REPORT
PROJECT: Phase C, Tippecanoe Laboratories

BORING/WELL NO: MW-N (FP-12) = T1834

Date Installed/Completed: 11 / 21 / 85

Contractor: TSC

General Location: Floodplain

Coordinates: North 21+22
East 03+09

Top Elevations: Ground 517.7 T.O.C.: 520.21

Bottom Elevations: Boring: 487.7 Well: 490.21 Seal: 500-503

Drilled Diameter: 7 "
Drilled Depth: 30'

Drilling Method: Hollow Stem w/ plug.
Drilling Fluid: "Revert" during well installation only

Cased/Screened: Yes X No __

Casing Type Galvanized steel Diam. 3" From +2.5 To 2.5' stickup
Screen Type 10-slot stainless steel Diam. 3" From -27.5 To -22.5'

Other Materials Installed (Type, Size, Depth):
5-ft. surface protective casing, 6" square steel to -2' set in grout.

Gravel Packed: Yes X No __ Materials Pea Gravel
Grouted: Yes X No __ Materials Cement-Bentonite
Backfilled: Yes X No __ Materials Cave;

Geologic/Soil Log Available: Yes X No __
Field Permeability Tests Available: Yes __ No __ Type ___
Static Water Level: TOC Depth 15.50 Date 1 / 20 / 86

Formations Passed Through	Depth From	Depth To	Elev. From	Elev. To	Thickness
FILL	0	4	517.7	513.7	4
Unit IV (Alluvials)	4	30	513.4	487.7	>26'

Remarks:
Groundwater had slight solvent odor.
Wellpoint set in a medium-coarse sand.

(Attach Well Construction Sketch)

Engineer/Inspector: RL Johnson Date: 1/86

HARZA ENGINEERING COMPANY

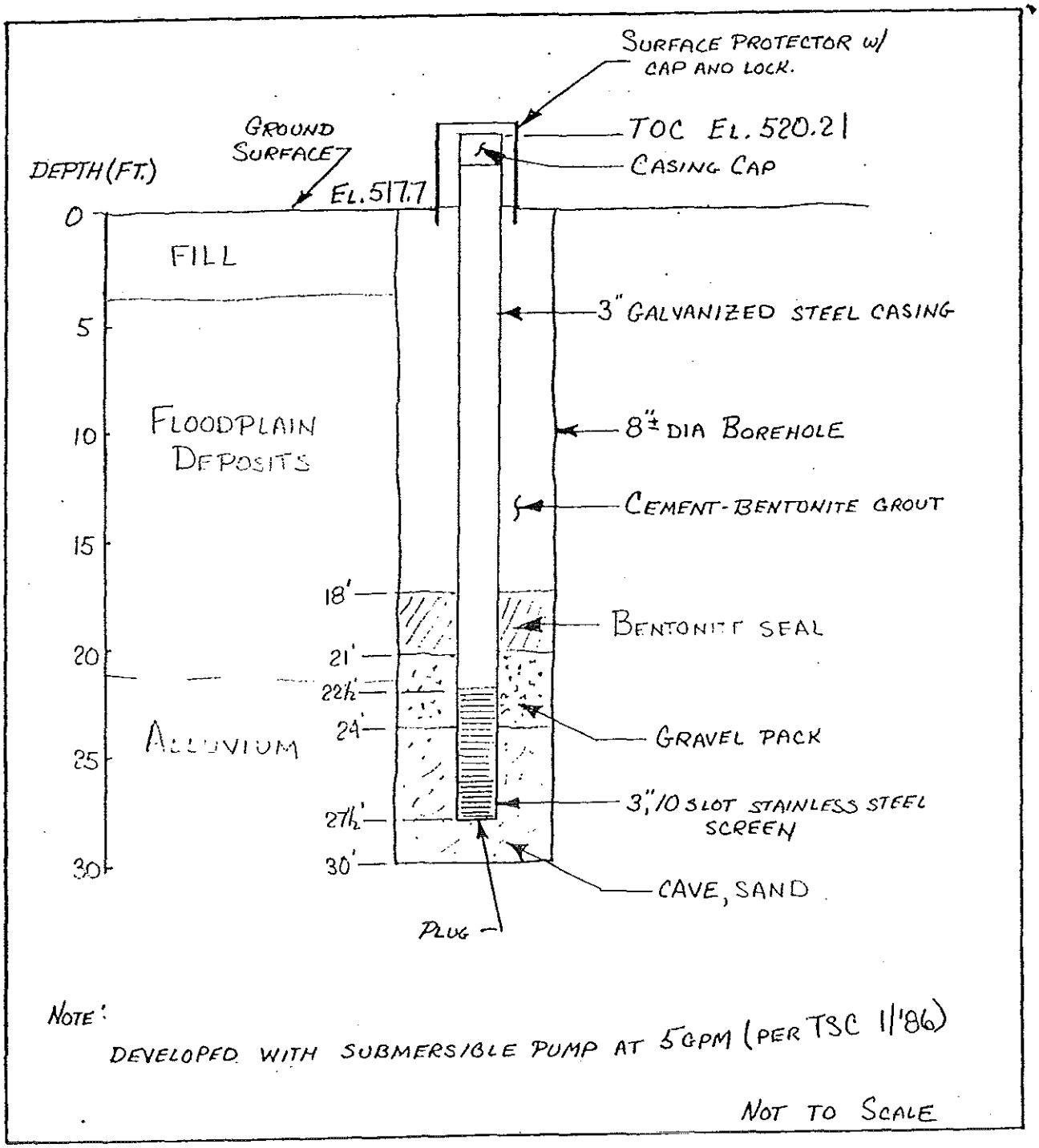
Page
T1834

WELL CONSTRUCTION SKETCH
PROJECT: Phase C, Tippecanoe Laboratories

WELL NUMBER: MW-N = T1834

COORDINATES: North 21+22
East 03+09

ELEVATIONS: Ground 517.7
T.O.C. 520.21



NOTE:
DEVELOPED WITH SUBMERSIBLE PUMP AT 5 GPM (PER TSC 1/'86)

NOT TO SCALE

Engineer/Inspector: R L Johnson Date: 1/'86

HARZA ENGINEERING COMPANY

SOIL BORING LOG

Project Name ELC - PHASE C

Project Number 1684
Client ELC
Contractor TSC
Drilling Method HS w/o PLUG, ROTARY/REVERT
Hole Size 7", REAMED TO 8'
Driller JERRY
Logged by RLJ

WATER LEVEL	62'	62½'	64.57
TIME	DURING	AFTER	DEVELP WELL
DATE	12/17	12/17	1/20/86

Sample Hammer: Weight 140#
Drop 30"
Sampler Dimensions SPT

Boring No. MW-YY1837
Location NEAR WEST AREA, SPLIT MW-V
Coordinates: N 04+73
E -20+45
Ground Elevation 606.6
Total Depth 70 FT.
Date Started 12/16/85 OVERCAST COOL
Date Completed 12/17/85 OVERCAST SNOW COLD

Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Sampler Type	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Casing Depth (ft/m)	Unified Soil Classification	SOIL DESCRIPTION	NOTES AND FIELD TESTS
									Surface Conditions: OLD PASTURE - GRASSES.	
								OL	BROWN SANDY CLAYEY TOPSOIL	"VERY MOIST"
	3½			6						
	-	S1A		14						
5	5	S1B	SS	11	18"	11"	-		DENSE BROWN FN-CRS SAND AND SM GRAVEL, SUBROUNDED COARSER OF VARIABLE COLOR	"MOIST"
								SW-GP		
	8½			9						
	-			12						
10	10	S2	SS	8	18"	10"	-	SP	DENSE BROWN MO TO CRS SAND TRACE GRAVELS, SUBROUNDED COARSER OF VARIABLE COLOR	"MOIST"
	13½			15						
	-			22						"MOIST"
15	15	S3	SS	25	18"	10"	-	SP	SAME	END DRILLING 12/16
										START DRILLING 12/17
	18½			24					VERY DENSE BROWN MO-CRS SAND TO SM GRAVEL, SUBROUNDED LITTLE GRAVELS AND COBBLE COARSER OF VARIABLE COLOR.	"MOIST"
	-			40						
20	20	S4	SS	43	18"	12"	-	SP		
	23½			61					COBBLE AT -24'	
	-			50/5"	11"	0	-			
25	25	S5	SS							
	28½			31					LG GRAVEL AT -29'	
	-			42						
30	30	S6	SS	49	18"	3"	-			
	33½			18					DENSE BROWN MO TO CRS SAND, SUBROUNDED TRACE GRAVEL COARSER OF VARIABLE COLOR	"MOIST"
	-			27						
35	35	S7	SS	28	18"	14"	-	SP		
	36½			27						
	-			42						"MOIST"
40	40	S8	SS	47	18"	12"	-	SP	CON'T	

HARZA ENGINEERING COMPANY

Page

T1837

BORING/WELL COMPLETION REPORT
PROJECT: Phase C, Tippecanoe Laboratories

BORING/WELL NO: MW-Y = T1837

Date Installed/Completed: 12 / 17 / '85

Contractor: TSC

General Location: BETWEEN MAIN PLANT AND WEST FARM.

Coordinates: North 04+73
East -20+45

Top Elevations: Ground 606.6 T.O.C.: 608.86

Bottom Elevations: Boring: 536.6 Well: 538.86 Seal: 552-554

Drilled Diameter: 7" REAMED TO 8" Drilling Method: HOLLOW STEM W/O PLUG, ROTARY REAM
Drilled Depth: 70' Drilling Fluid: "REVERT" DURING REAM

Cased/Screened: Yes X No

Casing Type GALVANIZED STEEL Diam. 3" From 63 To 2' STICK
Screen Type 10-SLOT STAINLESS STEEL Diam. 3" From 68' To 63

Other Materials Installed (Type, Size, Depth):
5 FT SURFACE PROTECTIVE CASING, 6" SQUARE STEEL TO -2½' SET IN "QUIK-CRETE"

Gravel Packed: Yes X No Materials PEA GRAVEL
Grouted: Yes X No Materials CEMENT-BENTONITE
Backfilled: Yes X No Materials SAND CAVE

Geologic/Soil Log Available: Yes X No
Field Permeability Tests Available: Yes No Type
Static Water Level: Depth 64.57 Date 1 / 20 / '86

Formations Passed Through	Depth From	Depth To	Elev. From	Elev. To	Thickness
TOPSOIL	0	4	606.6	602.6	4'
UNIT I (SAND & GRAVEL)	4	66	602.6	540.6	62'
UNIT II (TILL - CLAYEY)	66	70	540.6	536.6	> 4'

Remarks:
GROUNDWATER HAD SLIGHT SOLVENT ODOR.

(Attach Well Construction Sketch)

Engineer/Inspector: R L Johnson Date: 1/'86

T1837

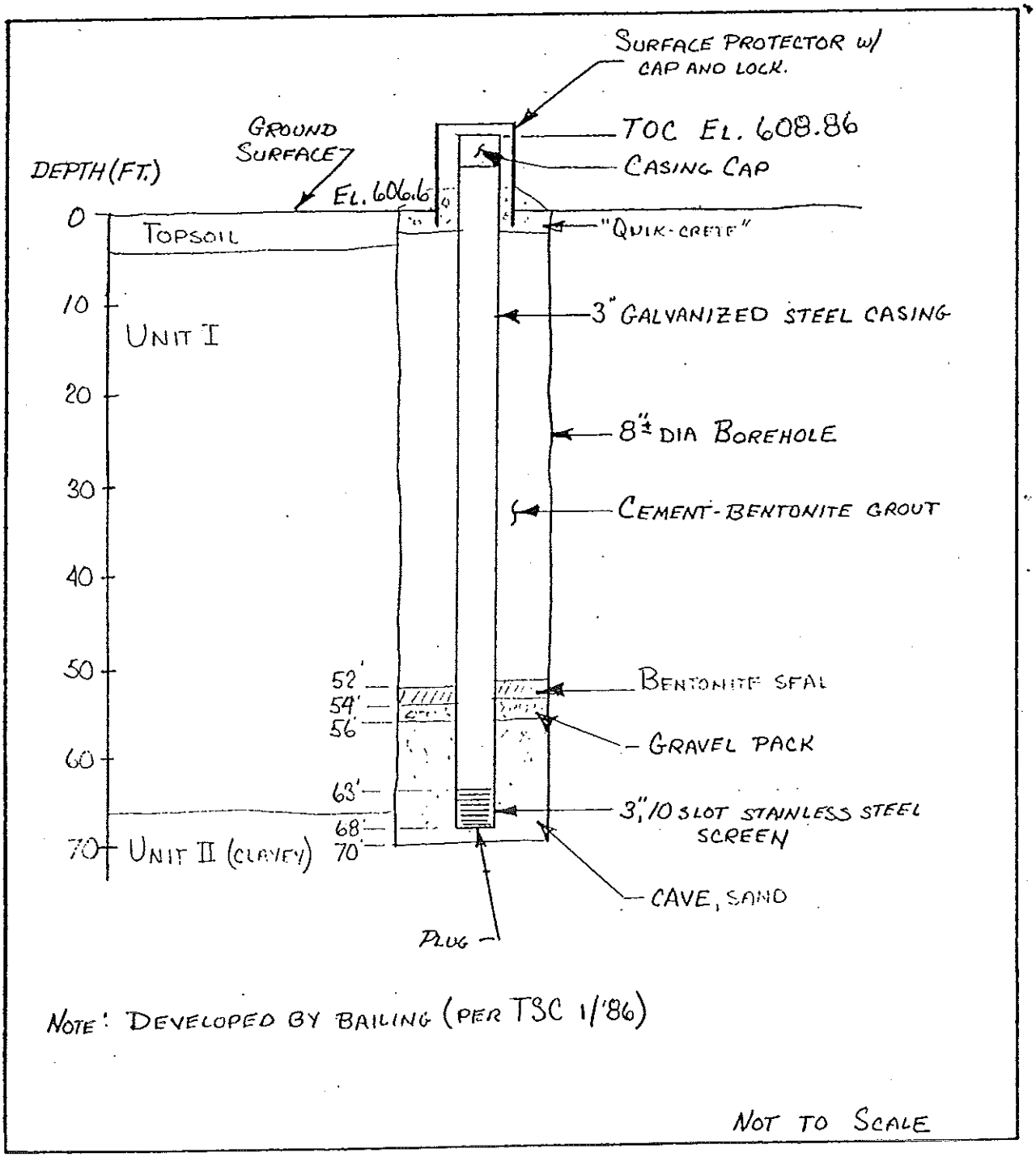
WELL CONSTRUCTION SKETCH

PROJECT: Phase C, Tippecanoe Laboratories

WELL NUMBER: MW-Y = T1837

COORDINATES: North 04+73
East -20+45

ELEVATIONS: Ground 606.6
T.O.C. 608.86



NOTE: DEVELOPED BY BAILING (PER TSC 1/'86)

NOT TO SCALE

Engineer/Inspector: R L Johnson Date: 1/86

HARZA ENGINEERING COMPANY

Sheet 2 of 2

SOIL BORING LOG

T1838s

Project Name ELC-PHASE C

Project Number 1684

Client ELC

Contractor TSC

Drilling Method HS w/o PLUG, ROTARY

Hole Size 7" REAMED TO 8" W/REVERT

Driller JERRY

Logged by RLJ

WATER LEVEL	-63'	-63'	65.42
TIME	DURING	AFTER	DEVEL'D WELL
DATE	11/3	11/3	12/20/86

Sample Hammer: Weight 140#

Drop 30"

Sampler Dimensions SPT

Boring No. MW-5S

Location 5' S OF BH-5

Coordinates: N 05+44

E -12+69

Ground Elevation 610.0

Total Depth 90 FT (SEE MW-5 & 5d)

Date Started 12/3/85 CLOUDY COOL

Date Completed 12/11/85

Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Sampler Type	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Casing Depth (ft/m)	Unified Soil Classification FIELD	SOIL DESCRIPTION	NOTES AND FIELD TESTS
									Surface Conditions: TANK PAD	
50										
	53½			31					0-53½' SEE SOIL BORING LOG MW-5	
	-			50/2"				GP.		
55	55	S11	SS	-	18"	8'	-	SP	GRAVEL-COBBLE-BOULDER LAYER SOME BROWN MO-CRS SAND COARSER LIMESTONE OR GRANITE ANGULAR PES OTHER SUBROUNDED	"MOIST TO DRY" EASIER DRILLING FROM ~56'.
	58½			13						
	-			50						
60	60	12	SS	-	12"	9"	-	SP	DENSE BROWN MO-CRS SAND LITTLE GRAVEL SUBANGULAR TO SUBROUNDED COARSER OF VARIABLE COLOR	
	63½			13						▽ -63'
	-			22						
65	65	13	SS	26	18"	13'	-	SP	DENSE GRAY CRS TO MO SAND; LITTLE SM TO MO GRAVEL, SUBROUNDED TO ROUNDED ("PEBBLES") TRACE FINES OCCASIONAL COBBLE.	"SATURATED" SLIGHT SOLVENT ODORS
	68½			17						"SATURATED"
	-			26						MODERATE SOLVENT ODORS
70	70	14	SS	(45)	16'	13"	-	SP	SAME.	S-14, SAMPLER OVERFILLED THROUGH 8' BLOW UP HS.
	73½			45						
	-			59¾"						
75	75	15	SS	-	10"	9'	-	SP	DENSE GRAY CRS SAND AND SM GRAVEL MATERIAL HAS BROWN TAINT. MOSTLY SUBROUNDED TO ROUNDED TRACE FINES OCCASIONAL COBBLE.	"SATURATED" MODERATE SOLVENT ODOR.
	78½			36						
	-			50/5"						"SATURATED"
80	80	16	SS	-	11"	11'	-	SP	SAME	MODERATE SOLVENT ODOR.

HARZA ENGINEERING COMPANY

Sheet 5 of 5

SOIL BORING LOG

Project Number 1684
Project Name ELC-PHASE C
Client ELC
Contractor TSC
Drilling Method 4" ROTARY & 8" ROTARY w/ REVERSE
Hole Size 4" REAMED TO 8"
Driller JERRY
Logged by RLJ
Sample Hammer: Weight 140#
Drop 30"
Sampler Dimensions SPT

WATER LEVEL	SEE MW-Ss	65.09
TIME	—	— DEVEL'D WELL
DATE	—	— 1/20/86

Boring No. MW-Sd = T183
Location 8' W of MW-Ss
Coordinates: N 05+44
E -12+78
Ground Elevation 609.9
Total Depth 95 FT (SEE MW-S & Ss)
Date Started 12/10/85 OVERCAST, RAIN COOL
Date Completed 12/10/85

Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Sampler Type	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Casing Depth (ft/m)	Unified Soil Classification FIELD
85								
90								
	93½			61				SM
	–	SAA		71				
95	95	S198	SS	32	18"	18"	8'	CL

SOIL DESCRIPTION

Surface Conditions: TANK PAD

0-90' SEE SOIL BORING LOGS MW-S & Ss

VERY DENSE GRAY FN SANDY SILT (TILL)

VERY TOUGH GRAY SILTY CLAY TRACE SANDS (TILL)

EOB -95'

3' WELL POINT: 83-78'
CAVE: 95-78'
GRAVEL PACK: 78-73'
SEAL: 73-71'
ELEVATION TOC: 610.71

NOTES AND FIELD TESTS

DRILLED NOTES
DRILLING CHANGE AT -91'
"SATURATED"
"MOIST"

WELL DATA

HOLE GROUTED ABOVE SEAL.

HARZA ENGINEERING COMPANY

Sheet 4 of 5

SOIL BORING LOG

T18385

Project Name ELC-PHASE C

Project Number 1684

Client

Contractor

Drilling Method

Hole Size

Driller

Logged by

WATER LEVEL			
TIME			
DATE			

Sample Hammer: Weight

Drop

Sampler Dimensions

Boring No. MW-Ss

Location

Coordinates: N

E

Ground Elevation

Total Depth

Date Started

Date Completed

Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Sampler Type	Blows per 6 in/15cm	Length Driven (in/cm)	Length Recovered (in/cm)	Casing Depth (ft/m)	Unified Soil Classification FIELD	SOIL DESCRIPTION	NOTES AND FIELD TESTS
									Surface Conditions:	
	83½			12					DENSE GRAY SILTY FN SAND (TILL)	"SATURATED" MODERATE SOLVENT ODOR.
	-			34				SP-SM		
85	85	S17	SS	41	18"	13"	-	SM		
	88½			17					SAME	"SATURATED" MODERATE SOLVENT ODOR.
	-			24				SP-SM		
90	90	S18	SS	42	18"	16"	-	SM		
									SEE SOIL BORING LOG MW-Sd	ADDITIONAL HS AUGER NOT AVAILABLE
										ON 12/10/85, FILL OPEN HOLE (TO -56') WITH REVERT. REAM WITH 8" ROTARY TO -63' ON 12/11/85.
									3" WELL POINT: -68-63'	WELL DATA
									CAVE: 90-59'	
									GRAVEL PACK: 59-56'	
									SEAL: 56-54'	HOLE GROUTED ABOVE SEAL.
									ELEVATION TOC: 612.12	

HARZA ENGINEERING COMPANY

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T 1838

BORING/WELL COMPLETION REPORT
PROJECT: Phase C, Tippecanoe Laboratories

BORING/WELL NO: MW-Ss = T1838s

Date Installed/Completed: 12 / 11 / '85

Contractor: TSC

General Location: SW Field, within Main Plant property

Coordinates: North 05+44
East -12+69

Top Elevations: Ground 610.0 T.O.C.: 612.12

Bottom Elevations: Boring: 520.0 Well: 542.12 Seal: 554-552

Drilled Diameter: 7" reamed to 8" Drilling Method: Hollow Stem w/o Plug. Rotary ream
Drilled Depth: 90' Drilling Fluid: "Revert" during ream

Cased/Screened: Yes X No __

Casing Type Galvanized steel Diam. 3" From -63' To 2' stickup
Screen Type 10-slot stainless steel Diam. 3" From -68' To -63'

Other Materials Installed (Type, Size, Depth):
5 ft surface protective casing, 6" square steel to -2½' set in "Quick-crete"

Gravel Packed: Yes X No __ Materials Pea gravel
Grouted: Yes X No __ Materials cement-bentonite
Backfilled: Yes X No __ Materials Sand cave

Geologic/Soil Log Available: Yes X No __
Field Permeability Tests Available: Yes __ No __ Type ____
Static Water Level: TOC Depth 65.42 Date 1 / 20 / '86

For MW-S location Formations Passed Through	Depth From	Depth To	Elev. From	Elev. To	Thickness
Fill	0	7'	610.0	603.0	7'
Unit I (Sand & gravel)	7	82'	603.0	528.0	75'
(Boulder	50.5	~55	559.5	~555.0	~4.5')
Unit II (Till - sandy)	82'	94.5	528.0	515.5	12.5'
Unit II (Till - clayey)	94.5'	95	515.5	515	> .5'

Remarks:
MW-S was drilled and sampled 5' N of MW-Ss. Twenty-five of Hollow-stem auger was sheared and left in borehole.
MW-Ss drilled to 90'; no more HS available.
See MW-Sd

(Attach Well Construction Sketch)

Engineer/Inspector: R L Johnson Date: 1/'86

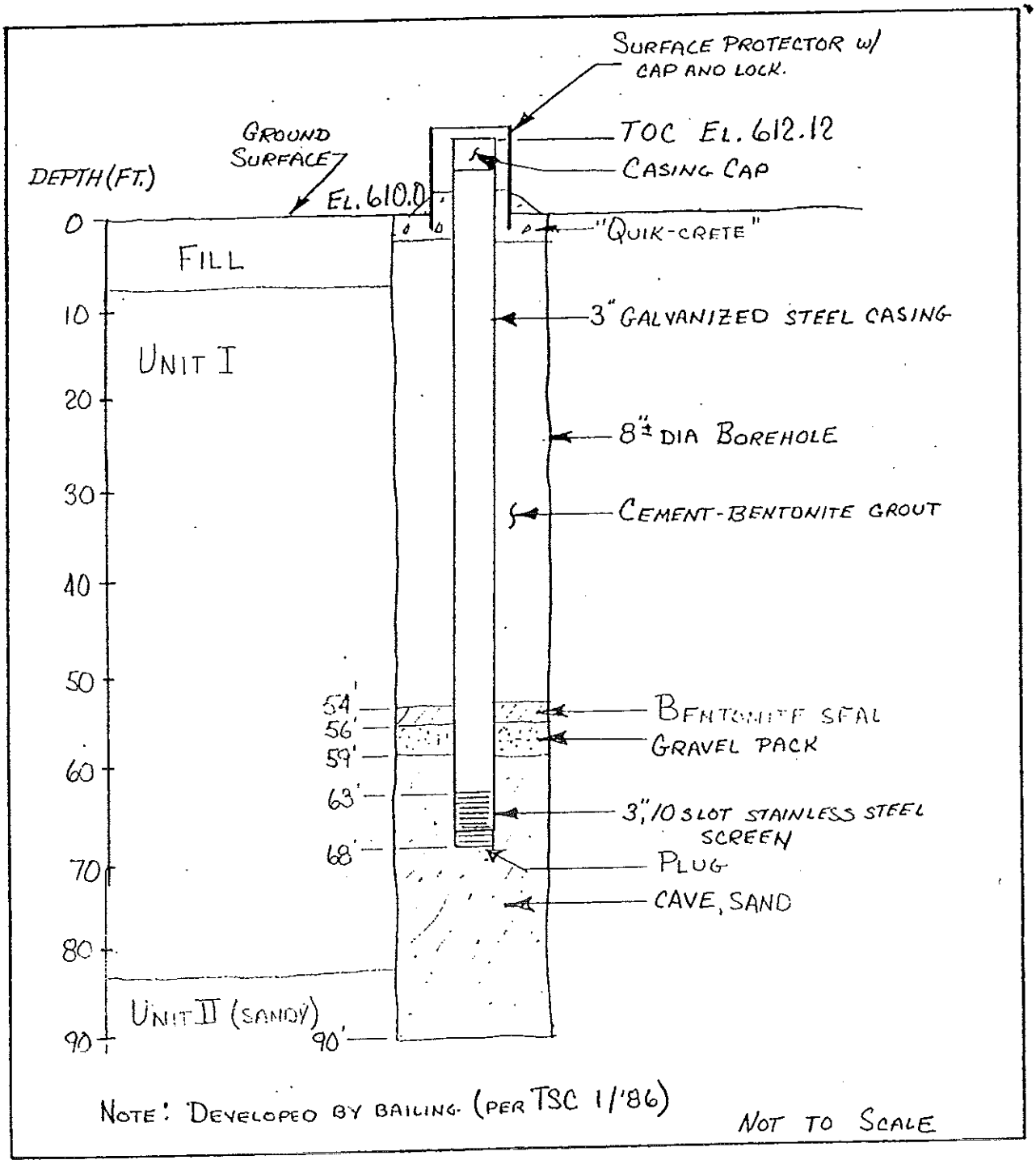
HARZA ENGINEERING COMPANY

Page __
T1838

WELL CONSTRUCTION SKETCH
PROJECT: Phase C, Tippecanoe Laboratories
WELL NUMBER: MW-Ss = T1838s

COORDINATES: North 05+44
East -12+69

ELEVATIONS: Ground 610.0
T.O.C. 612.12



Engineer/Inspector: R L Johnson Date: 1/86

HARZA ENGINEERING COMPANY

Page ____

T1838

BORING/WELL COMPLETION REPORT
PROJECT: Phase C, Tippecanoe Laboratories

BORING/WELL NO: MW-Sd = T1838d

Date Installed/Completed: 12 / 10 / 85

Contractor: TSC

General Location: SW Field, with Main Plant property

Coordinates: North 05+44
East -12+78

Top Elevations: Ground 609.9 T.O.C.: 610.71

Bottom Elevations: Boring: 514.9 Well: 525.72 Seal: 537-535

Drilled Diameter: 4" reamed to 8" Drilling Method: Rotary
Drilled Depth: 95' Drilling Fluid: "Revert"

Cased/Screened: Yes X No __

Casing Type Galvanized steel Diam. 3" From -78' To 2' stickup
Screen Type 10-slot stainless steel Diam. 3" From -83 To -78'

Other Materials Installed (Type, Size, Depth):
5 FT. surface protective casing, 6" square steel to -2½' set in "Quik-crete"

Gravel Packed: Yes X No __ Materials Pea gravel
Grouted: Yes X No __ Materials Cement:bentonite
Backfilled: Yes X No __ Materials Sand cave

Geologic/Soil Log Available: Yes X No __
Field Permeability Tests Available: Yes __ No __ Type ____
Static Water Level: TOC Depth 65.09 Date 1 / 20 / 86

For MW-S location Formations Passed Through	Depth From	Depth To	Elev. From	Elev. To	Thickness
Fill	0	7'	610.0	603.0	7'
Unit I (Sand & gravel)	7	82'	603.0	528.0	75'
(Boulder	50.5	~55	559.5	~555.0	~4.5')
Unit II (Till-sandy)	82'	94.5'	528.0	515.5	12.5'
Unit II (Till-clayey)	94.5	95	515.5	515	>.5'

Remarks:
See MW-S
MW-Sd was drilled 8' W of MW-Ss, using rotary method only

(Attach Well Construction Sketch)

Engineer/Inspector: RL Johnson Date: 1/86

RZA ENGINEERING COMPANY

Page __

T1838

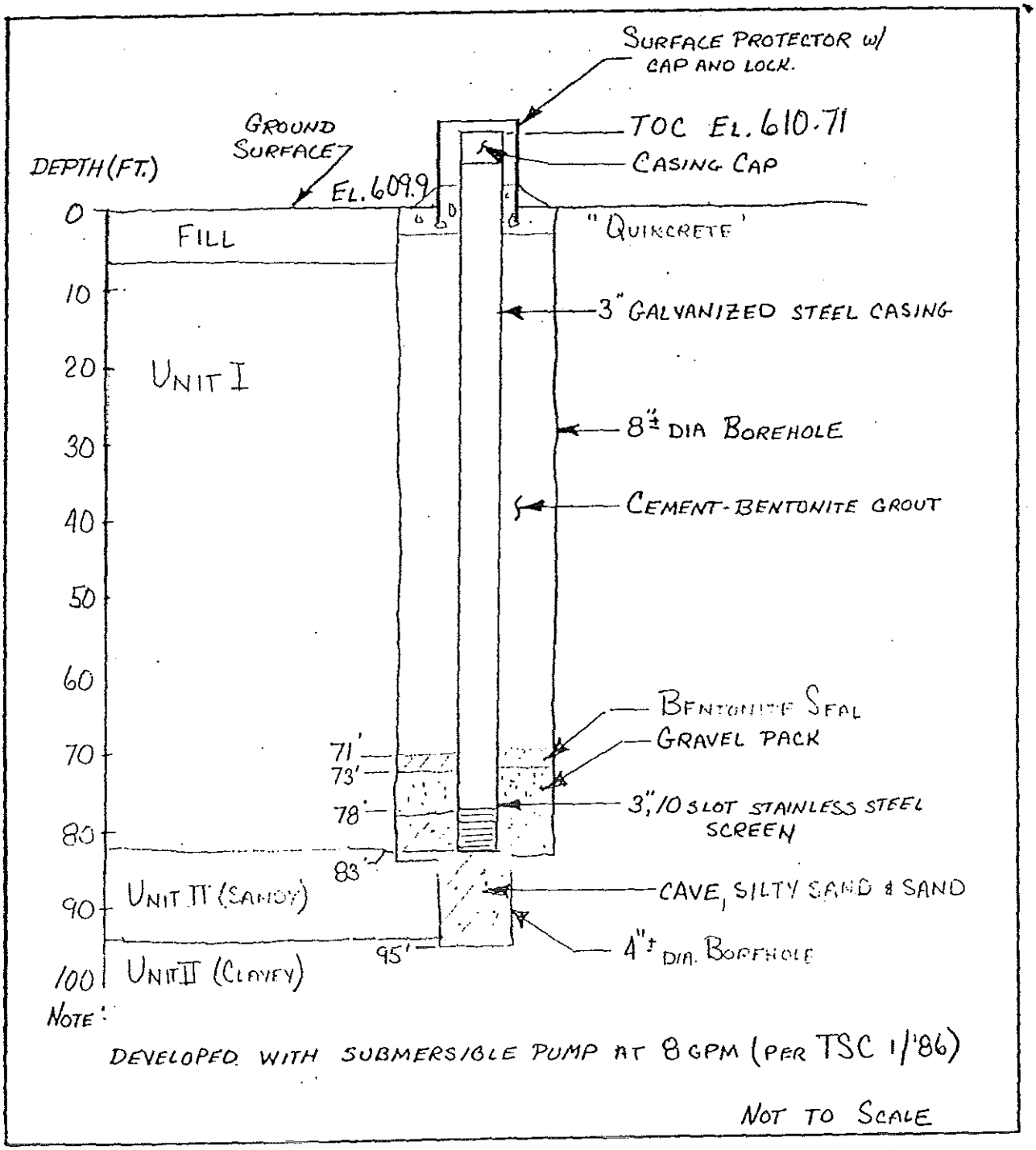
WELL CONSTRUCTION SKETCH

PROJECT: Phase C, Tippecanoe Laboratories

WELL NUMBER: MW-5d = T1838d

COORDINATES: North 05+44
East -12+78

ELEVATIONS: Ground 609.9
T.O.C. 610.71



NOTE:

DEVELOPED WITH SUBMERSIBLE PUMP AT 8 GPM (PER TSC 1/'86)

NOT TO SCALE

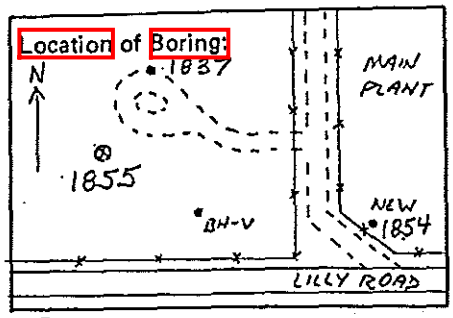
Engineer/Inspector: R.L. Johnson Date: 1/'86

SOIL BORING LOG

HES HARZA ENVIRONMENTAL SERVICES, INC.

Sheet 1 of 3

PROJECT: ELC 1919 D



Water Depth: 68 -
Date: 1-8-87
Time: 11:30a
Hole Depth: 70
Casing Depth: 70

Drilling Method (s): 7" H.S. AUGER

Hole/Casing Size (s): 12" H.S. TO 55 FT & 6" TO 74.5 FT / 3 IN. FLUSH JOINT

Boring No.: T1855 (#6)
Feature: WEST END
Coordinates: N 281.32
E -2,164.27
Ground Elevation: 608.2
Casing Elevation: 610.46
Total Depth: 75.5
Bottom Elevation: 532.7

Date Started: 1-7-87 Time: 2:30
Date Completed: 1-8-87 Time: 12:00

Sampling Method (s): SPT 24 IN. SPOON AT 2.5 FT. INTERVALS

Sample Dimensions: 1.37 IN. I.D Hammer Weight/Drop: 140# / 30 IN.

Surface Conditions: TALL GRASS - LEVEL & DRY

Drilling Contractor: TSC Logged By: T.E. WRIGHT Checked By: Date:

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
									0-1 TOPSOIL	
	1	1	4-5 4-4	24	4		CL		1-3 SOFT, REDDISH-BRN, CLAYEY SILT, SILTY CLAY, MINOR SAND %	MOIST
	3	2	5-4 5-6	24	13		SP-GP		3-11.5 LOOSE, BROWN, SAND, MED-CRS. & GRAVEL UP TO 1 IN.+, POORLY GRADED, ROUNDED.	DRY
5	5									
		3	4-6 8-10	24	16					
	8½	4	8-12 13-14	24	18				FIRM SAND & GRAVEL - SAME	DRY
10	10½									
		5	10-13 7-15	24	19		SW-SP		11.5-23.5 DENSE, BROWN, SAND MED-CRS, ROUNDED W/GRAVEL UP TO 3/4 IN., MOST SIZES PRESENT.	DRY
	13½	6	7-11 16-19	24	21					
15	15½									
		7	10-14 19-16	24	18					
	18½	8	8-13 12-16	24	20				- SAME -	DRY
20	20½									
		9	14-32 39-27	24	20					
	23½	10	13-19 20-21	24	21		SP		23.5-91.5 DENSE, BROWN, SAND, FN-CRS, POORLY GRADED, ROUNDED.	DRY
25	25½									
		11	7-16 18-17	24	18					
	28½	12	9-13 16-19	24	20					
30										

SOIL BORING LOG
(Continued)

HESHARZA ENVIRONMENTAL SERVICES, INC.

Sheet 2 of 3

PROJECT: ELC 1919 D

Boring No.: T1855 (#6)

Drilling Contractor: TSC Logged By: T.E. Wright Checked By: Date:

Sampling Method(s):

Sample Dimensions: Hammer Weight/Drop: /

Surface Conditions:

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
30	30½								- SAME -	DRY
		13	15-27 33-33	24	19					
	33½	14	13-21 23-26	24	18					
35	35½									
		15	10-24 28-28	24	18				- SAME -	DRY
	38½	16	21-31 40-50	24	19					
40	40½									
		17	18-46 43-50	24	18		SW-SP		41.5 - 53.5 V. DENSE, BROWN, SAND, FN-MED-CRS, MOST SIZES PRESENT, ROUNDED	DRY
	43½	18	20-23 26-36	24	17					
45	45½									
		19	17-28 34-49	24	19					
	48½	20	18-50 40-43	24	18				- SAME - W/ INCREASE IN IRON STAINING.	DRY
50	50½									
		21	15-37 33-38	24	21					
	53½	22	13-39 49-50	22	19		SP-GP		53.5 - 63.5 V. DENSE, BROWN, SAND, MED-CRS, & GRAVEL, UP TO 1 IN. +, ROUNDED SLIGHT CEMENTATION FROM CALCITE &/OR "IRON PAN" (?)	DRY
55	55½									
		23	20-47 51-50	20	18					
	58½	24	21-30 28-34	24	20					
60	60½									
		25	44-46 37-38	24	18					
	63½	26	33-76 64-51	24	18		SP GP		63.5 - 69.0 V. DENSE, BROWN-DARK BRN., SAND, MED-CRS, & GRAVEL, UP TO 1 IN.+ POORLY GRADED, SUB-RND.	DRY MOIST SATURATED
65	65½									
		27	100 - —	1	1					
	68½	28	29-52 23-55	24	19					
70										

SOIL BORING LOG
(Continued)

HES HARZA ENVIRONMENTAL SERVICES, INC.

Sheet 3 of 3

PROJECT: ELC 1919 D

Boring No.: T1855 (#6)

Drilling Contractor: TSC

Logged By: T.E. Weigert

Checked By:

Date:

Sampling Method(s):

Sample Dimensions: Hammer Weight/Drop: /

Surface Conditions:

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
70	70½						CL		69.0- V. STIFF, GRAY W/ BROWN STREAKS	MOIST
		29	21-30 24-50	24	20				75.5+ SILTY CLAY, MOD-HIGH PLAST, TOUGH	
	73½									
75		30	33-48 50 -	16	19					
	75½								E.O.B. @ 75.5 FT.	

WELL INSTALLATION :

WELL SCREEN	-72.5 TO -62.5
SAND/NATURAL BACKFILL	-75.5 TO -53
VOLCLAY GROUT	-53 TO -3

HARZA ENVIRONMENTAL SERVICES, INC.

BORING/WELL COMPLETION REPORT

Project: ELC 1919 D

Boring/Well No: T1855(#6)

Date: Started 1-7-87
Completed 1-12-87
Coordinates: North 281.32
East -2,164.27
Drilling Method: 6IN. ROTARY
Drilling Fluid: REVERT THEN FLUSHED
Drilled Diameter: 6-7IN.

Contractor: TSC
Purpose: SOIL BORINGS/MONITOR WELL
Ground Elevation: 608.2
T.O.C. Elevation: 610.46
Drilled Depth: 75.5
Bottom Elevation: 532.7

SUMMARY BORING LOG

Formation	Depth From	Depth To	Elevation From	Elevation To	Thickness
SOFT, CLAYEY SILT, SILTY CLAY	1.0	3.0	607.2	605.2	2.0
LOOSE, SAND, MED-CRS & GRAVEL	3.0	11.5	605.2	596.7	8.5
DENSE, SAND, MED. CRS W/ GRAVEL (GRADED)	11.5	23.5	596.7	584.7	12.0
DENSE, SAND, FN-CRS	23.5	41.5	584.7	566.7	18.0
V. DENSE SAND, FN-MED (GRADED)	41.5	53.5	566.7	554.7	12.0
V. DENSE, SAND, MED-CRS & GRAVEL (CEMENTED)	53.5	63.5	554.7	544.7	10.0
V. DENSE, SAND, MED-CRS & GRAVEL	63.5	69.0	544.7	539.2	5.5
V. STIFF, CLAY, MED-HIGH PLAST, TOUGH	69.0	75.5+	539.2	532.7	6.5

BORING/WELL COMPLETION

Monitoring Well: X Piezometer: __ Grouted: __ Test Well: __
Pumping Well: __ Other (Describe): _____

WELL CONSTRUCTION

Casing

Type GALVANIZED/FLUSH JOINT
Diameter 3 IN.
Depth -67.5 to +2.5 FT

Type _____
Diameter _____
Depth _____ to _____

Screen

Type 5 FT. LONG 10 SLOT
Diameter 3 IN.
From -72.5 To -67.5

Gravel Pack: -75.5 to -53
Grout: -53 to -3
Seal: * to —

Comments: * SAND & NATURAL BACKFILL FILLED BOTTOM OF 12" HOLLOW STEM SO NO BENTONITE WAS USED.

REMARKS

HAD TO LEAVE WELL UNFINISHED OVER WEEKEND

Engineer/Inspector: J. E. WRIGHT

BK

[illegible] ENVIRONMENTAL SERVICES, INC.

T1855.

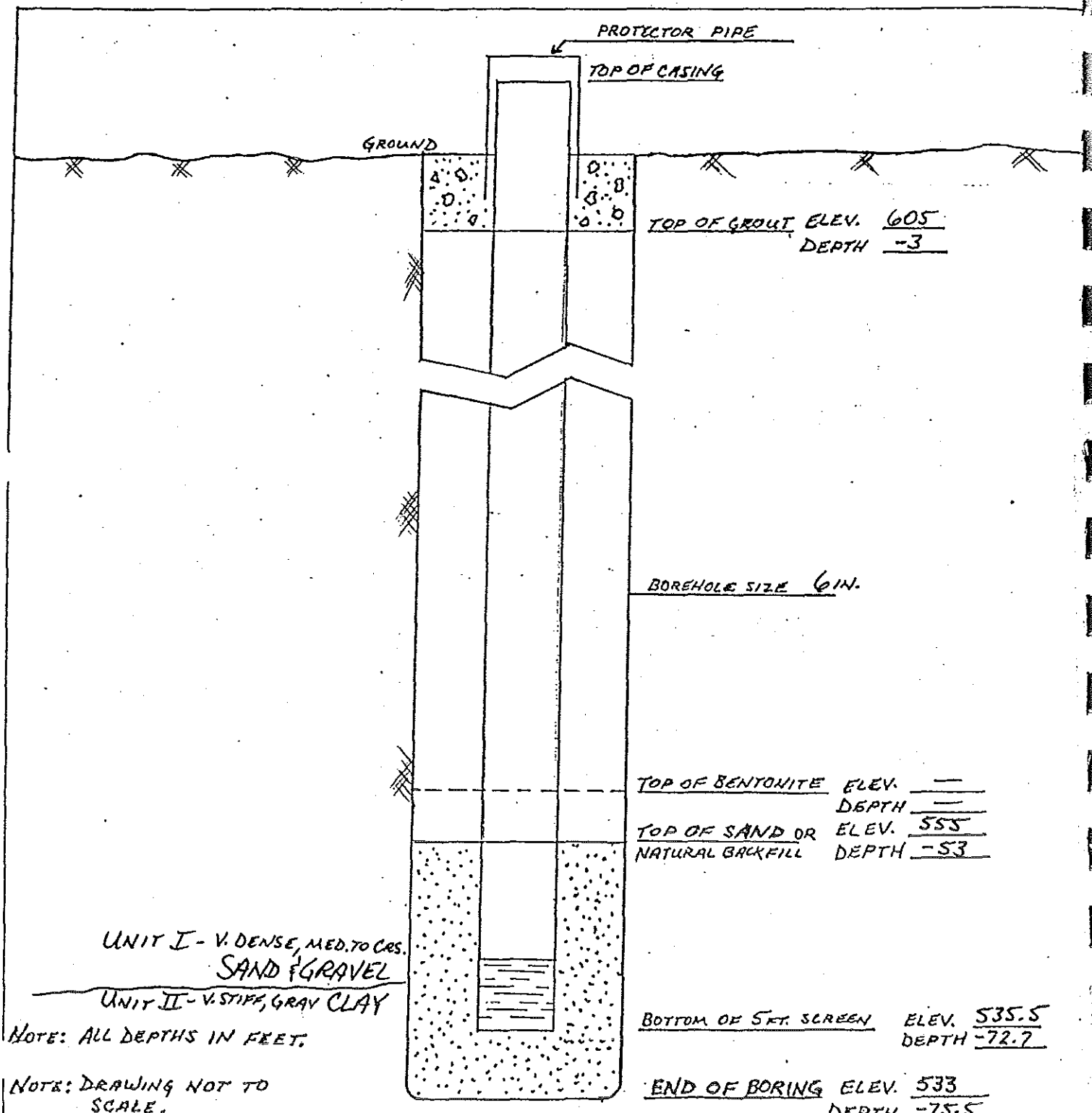
WELL CONSTRUCTION SKETCH

Project: ELC 1919 D

Well Number: 1855 (#6)

Coordinates: North 281.3243
East -2,164.2723

Elevations: Ground 608.2
T.O.C. 610.46



NOTE: ALL DEPTHS IN FEET.

NOTE: DRAWING NOT TO SCALE.

Engineer/Inspector: J.E. WRIGHT

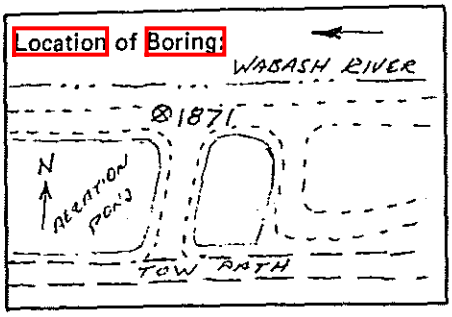
SOIL BORING LOG

HESHARZA ENVIRONMENTAL SERVICES, INC.

Sheet 1 of 2

PROJECT: 1919 D ELC

Location of Boring:



Water Depth: 25FT. 20 FT
Date: 11-20-86 11-21-86
Time: 10:15A 07:30A
Hole Depth: 25.5FT 35 FT
Casing Depth: 20 FT 33 FT

Drilling Method (s): H.S. AUGER 12" w/OUT PLUG

Hole/Casing Size (s): 12" O.D. BORING, 3" FLUSH JOINT CASING

Boring No.: T1871 (#17)
Feature: FLOOD PLANE - UNIT
Coordinates: N 2,205.58
E 213.85
Ground Elevation: 519.9
Casing Elevation: 521.79
Total Depth: 35'
Bottom Elevation: 484.9

Date Started: 11-20-86 Time: 8:30A
Date Completed: 11-20-86 Time: 11:30

Sampling Method (s): SAT 24" TUBE 2" O.D.

Sample Dimensions: 1-37" DIA. Hammer Weight/Drop: 140# / 30"

Surface Conditions: RIVER DIKE, ACCESS ROAD - ROAD BASE & FILL

Logged By: T.E. WELLS Checked By: _____ Date: _____

Drilling Contractor: TSC

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log			SOIL DESCRIPTION	REMARKS
	1	1A	10-12	24	24		—		0-4.5	FILL:	LOOSE BROWN GRAVEL, POORLY GRADED, FN. TO V. CRS. SAND	DRY - MOIST
	3	1B	8-8									
5	5.5	2	3-3 5-5	24	18		OL		4.5 - 11.8	LOOSE	GRAY SILTY CLAY, LOW PLAST BLACK ORGANIC INCLUSIONS, ORGANIC SMELL.	MOIST
	8	3	2-3 3-5	24	16							
10	10.5	4	2-4 6-6	24	16							
	13	5A	2-3	24	18		ML		11.8 - 16.3	LOOSE	DARK GRAY TO BLACK SILT & SILTY SAND FN GRAINED, SILT & SAND LENSES, ORGANIC SMELL	MOIST
		5B	4-3									
15	15.5	6	2-2 2-1	24	16							
	18	7	1-1 2-2	24	16		SM		16.3 - 18.9	LOOSE	GRAY SAND & SILTY SAND FN TO CRS GRAINED, LENSES	V. MOIST TO SAT.
20	20.5	8	1-1 1-2	24	24		ML		18.9 - 23.0	LOOSE	DARK GRAY TO BLACK SILT & SILTY SAND FN GRAINED, SILT & SAND LENSES, ORGANIC	▽ 11-21-86 V. MOIST
	23	9	2-3 3-8	24	18							
		10A	5-6	24	14		SM		23.0 - 25.0	LOOSE	GRAY SAND & SILTY SAND FN TO CRS GRAINED, W/ LENSES	SATURATED ▽ 11-20-86
25	25.5	10B	10-12									
		11	3-6 6-7	24	14		SP GP		25.0 - 31.8	LOOSE	GRAY TO BLACK SAND & GRAVEL POORLY GRADED, ROUNDED	SATURATED
	28											
30		12	3-5 4-4	24	14							

SOIL BORING LOG
(Continued)

HES HARZA ENVIRONMENTAL SERVICES, INC.

Sheet 2 of 2

PROJECT: ELC 1919D

Boring No.: 1871

Sampling Method(s): _____

Sample Dimensions: _____ Hammer Weight/Drop: _____ / _____

Surface Conditions: _____

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
30	30 1/4						SP			
	31									
		13	10-20 18-15	24	12		GP		31.8-35.0 LOOSE, DARK GRAY, GRAVEL, CRS. GRAINED SAND UP TO 1" PEBBLES, POORLY GRADED, ANG.-SUB-RND'D, SLIGHT SOLVENT SMELL.	SATURATED
	33									
	33 1/2									
		14	15-23 33-12	24	12					
35	35 1/2								E.O.B. AT 35.5 FT.	

WELL INSTALLATION:

WELL SCREEN	28-23 FT.
NATURAL BACKFILL	35-29 FT.
COARSE SAND	29-21 FT.
BENTONITE SEAL	21-20 FT.
VOLCLAY GROUT	20-2 FT.
SAKRETE	2-0 FT.
CASING STICK-UP	0+2 FT.

Drilling Contractor: TSC Logged By: J. E. WRIGHT Checked By: _____ Date: _____

HARZA ENVIRONMENTAL SERVICES, INC.

#1871

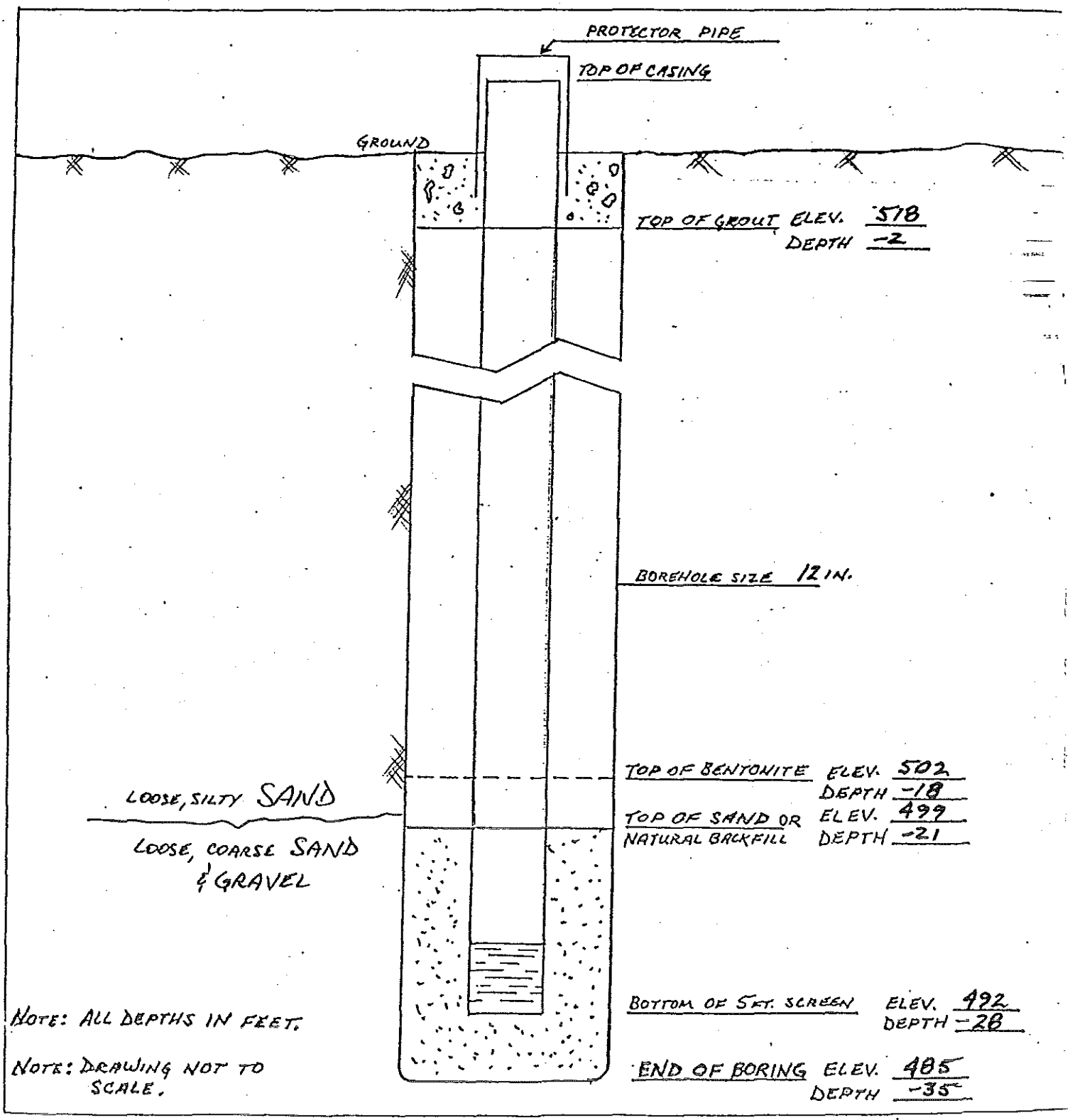
WELL CONSTRUCTION SKETCH

Project: ELC 1919 D

Well Number: 1871 (#17)

Coordinates: North 2,205.5806
East 213.8540

Elevations: Ground 519.9
T.O.C. 521.79



NOTE: ALL DEPTHS IN FEET.

NOTE: DRAWING NOT TO SCALE.

Engineer/Inspector: J.E. WRIGHT

HARZA ENVIRONMENTAL SERVICES, INC.

BORING/WELL COMPLETION REPORT

Project: 1684 ELC

Boring/Well No: T1871(#17)

Date: Started 11-20-86
Completed 11-21-86
Coordinates: North 2,205.58
East 213.85
Drilling Method: H.S. AUGER w/CASING
Drilling Fluid: NONE
Drilled Diameter: 12" O.D.

Contractor: TSC
Purpose: BORING/MONITOR WELL
Ground Elevation: 519.9
T.O.C. Elevation: 521.79
Drilled Depth: 35 FT
Bottom Elevation: 484.9

SUMMARY BORING LOG

Formation	Depth From	Depth To	Elevation From	Elevation To	Thickness
FILL - BROWN & GRAY; SAND, SILT, GRAVEL	0.0	-4.5	519.9	515.4	4.5
LOOSE GRAY CLAY, & SILTY CLAY	-4.5	-11.8	515.4	508.1	7.3
V. LOOSE DARK GRAY SILTY SAND	-11.8	-16.3	508.1	503.6	4.5
LOOSE GRAY COARSE SAND w/SILT	-16.3	-18.9	503.6	501.0	2.6
LOOSE DARK GRAY SILTY SAND	-18.9	-23.0	501.0	496.9	4.1
LOOSE GRAY COARSE SAND	-23.0	-25.0	496.9	494.9	2.0
LOOSE GRAY-BLACK SAND-GRAVEL	-25.0	-35.0+	494.9	484.9-	10.0+

BORING/WELL COMPLETION

Monitoring Well: X Piezometer: __ Grouted: __ Test Well: __
Pumping Well: __ Other (Describe): _____

WELL CONSTRUCTION

Casing

Type GALVANIZED/FLUSH
Diameter 3"
Depth -23 to +2'

Type _____
Diameter _____
Depth _____ to _____

Screen

Type 10 SLOT
Diameter 3"
From -28 To -23

Gravel Pack: -35 to -21
Grout: -18 to 0.0
Seal: -21 to -18

Comments: WATER LEVEL AT 15 FT

REMARKS

BENTONITE PELLETS BRIDGED AT ABOUT -15 FT (WATER LEVEL) AND PLUGGED THE H.S. AUGER WHICH HELD THE WELL CASING FIRM. WHEN THE AUGER WAS LIFTED THE WELL CASING LIFTED AS WELL AND HAD TO BE PUSH BACK DOWN WITH THE RIG HYDRAULICS. NO VISIBLE SIGNS OF DAMAGE WERE OBSERVED.

Engineer/Inspector: J.E. WRIGHT

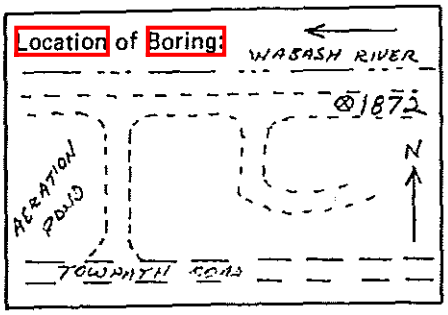
PAL

SOIL BORING LOG

HES HARZA ENVIRONMENTAL SERVICES, INC.

Sheet 1 of 2

PROJECT: 1919 D ELC



Water Depth: 19' - _____
Date: 11-25-86
Time: 08:00
Hole Depth: 40'
Casing Depth: 35'

Boring No.: T1872(#18)
Feature: FLOOD PLANE UNIT
Coordinates: N 2,253.81
E 468.75
Ground Elevation: 517.3
Casing Elevation: 520.23
Total Depth: 38 FT
Bottom Elevation: 480.3

Drilling Method (s): 12" H.S. AUGER W/OUT PLUG AND ROTARY (6" TRICONE)
Hole/Casing Size (s): 12" OD. BORING 3" FLUSH JOINT CASING

Date Started: 11-24-86 Time: 1:30 p
Date Completed: 11-24-86 Time: 5:30 p

Sampling Method (s): SPT 24" TUBE 2" DIA. O.D.
Sample Dimensions: 1.37" DIA. Hammer Weight/Drop: 140# / 30"
Surface Conditions: RIVER DIKE, ACCESS ROAD - ROAD BASE & FILL

Logged By: T.E. Weigner Checked By: _____ Date: _____
Drilling Contractor: TSC

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
									0-9.1 FILL: SOFT BROWN SILT TO CLAYEY SILT L. PLAST, L. STRGTH, EARTHY ODOR	DRY-MOIST
	3	1	10-10 10-8	24	16					
5	5.5	2	5-6 5-7	24	14					
	8	3	7-7 8-7	24	16				FILL: FIRM BROWN SILTY CLAY/CLAYEY SILT, L. PLAST, MOD. STRGTH EARTHY ODOR, FC STAINS MOTTLED	DRY-MOIST
10	10.5	4	4-3 4-4	24	16		SM		9.1 TO 16.5 LOOSE, BROWN(IRON) MOTTLED, SILTY SAND SANDY SILT w/CLAY BINDER L. PLAST, L. STRGTH, V. FN GRAINED SAND, EARTHY ODOR, FC ST	DRY-MOIST
	13	5	3-4 3-4	24	18					
15	15.5	6	3-3 3-3	24	16					
	18	7	2-2 1-2	24	14		SM		16.5 TO 19.8 LOOSE BLACK SILTY SAND, V. FN GRAINED w/ CLAY BINDER L. PLAST, L. STRGTH. ORGANIC	MOIST-WET TUBE WAS WET ▽ 11-25
20	20.5	8	1-1 1-2	24	18		OL-OH		19.8 TO 25.0 SOFT GRAY CLAYEY SILT, L.-MED. PLAST., CLAY LENSES, ORGANIC	MOIST
	23	9	1-2 1-2	24	16					
25	25.5	10	2-4 4-4	24	16					
	28	11	7-5 7-6	24	16		SP-SM		25.0 TO 31.5 LOOSE BLACK FN-CRS SAND w/ FEW PEBBLES, SLT. ORGANIC ODOR SUB-ANG TO SUB-RNDD SAME w/MORE PEBBLES & GRAVEL	WET-SAT
30		12	5-7 12-4	24	24					

SOIL BORING LOG
(Continued)

HES HARZA ENVIRONMENTAL SERVICES, INC.

Sheet 2 of 2

PROJECT: ELC 1919D

Boring No.: 1872

Sampling Method(s): _____

Sample Dimensions: _____ Hammer Weight/Drop: ____ / ____

Surface Conditions: _____

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
30	30.5						GM			
		13*	9-9 16-26	24	14		SM		31.5-38.0 LOOSE, BROWN, FN. SILTY SAND, MOIST, EARTHY ODOR.	SAND BLOWN UP INTO AUGER.
	33								SAME W/ GRAY CLAY LENSES ~1/4" THICK.	*COBBLE IN SAMPLER HAD TO WASH HOLE W/ REVERT.
35	35.5	14	12-20 27	18	14					
		15	20-26 23-25	24	16					
	38								E.O.B. AT 38 FT.	NO SAMPLE.

WELL INSTALLATION:

WELL SCREEN	30-25 FT
NATURAL BACKFILL	40-32 FT.
COARSE SAND	32-22 FT
BENTONITE SEAL	22-21 FT
VOLCLAY GROUT	21-3 FT
SAKRETE	3-0 FT
CASING STICK-UP**	0-2.5 FT.

** CUT TO FIT.

Drilling Contractor: TSC Logged By: J. SELLENT Checked By: _____ Date: _____

T1892

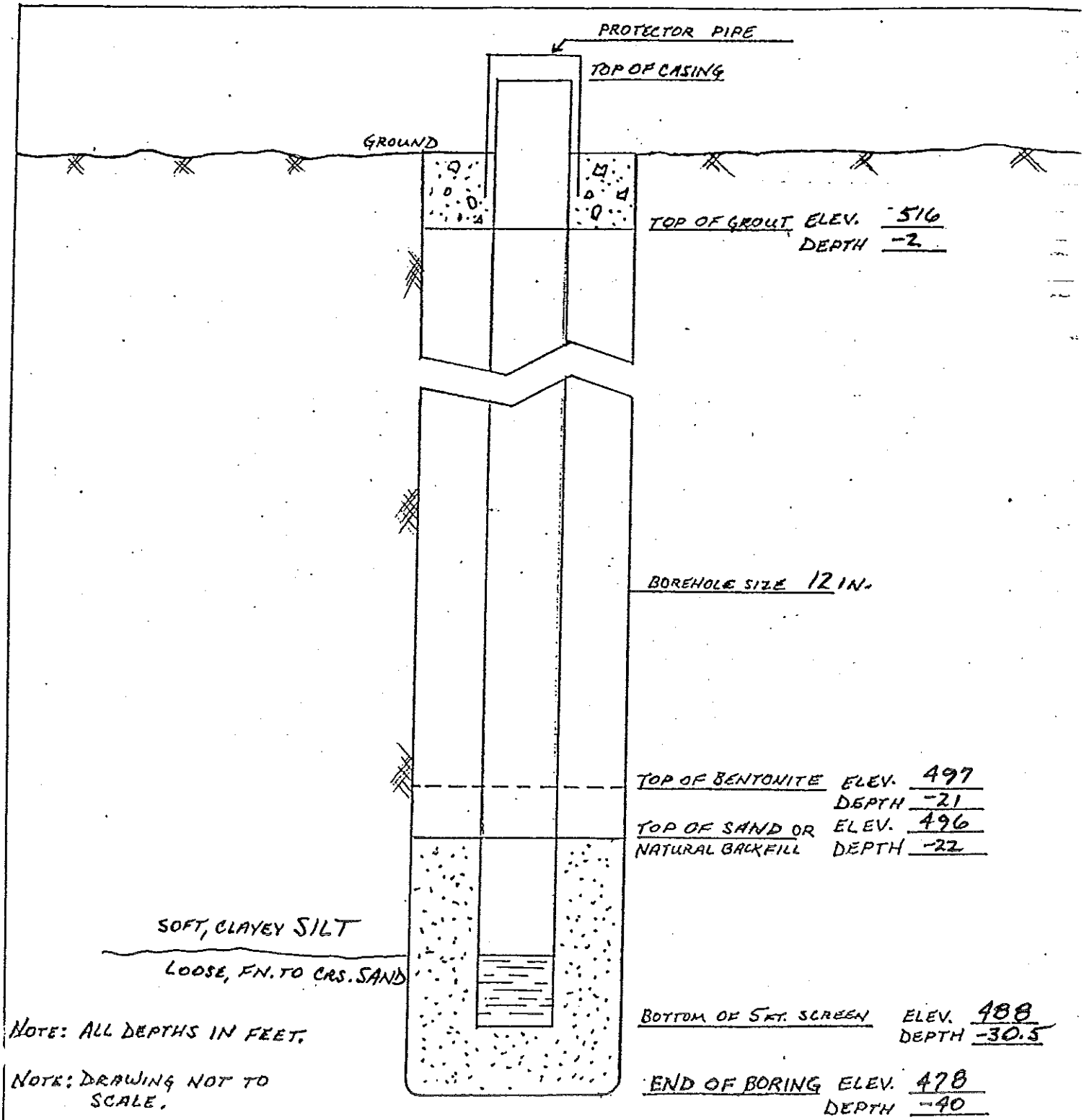
WELL CONSTRUCTION SKETCH

Project: ELC 1919 D

Well Number: 1872 (#18)

Coordinates: North 2,253.8071
East 468.7519

Elevations: Ground 518.3
T.O.C. 520.23



NOTE: ALL DEPTHS IN FEET.

NOTE: DRAWING NOT TO SCALE.

Engineer/Inspector: J.E. WRIGHT

HARZA ENVIRONMENTAL SERVICES, INC.

BORING/WELL COMPLETION REPORT

Project: 1684 D ELC

Boring/Well No: T1872(#18)

Date: Started 11-24-86
Completed 11-25-86
Coordinates: North 2,253.81
East 468.75
Drilling Method: H.S. AUGER w/OUT PLUG
Drilling Fluid: REVERT FROM 35-40'
Drilled Diameter: 12" O.D.

Contractor: TSC
Purpose: SOIL BORING/MONITOR WELL
Ground Elevation: 518.3
T.O.C. Elevation: 520.23
Drilled Depth: 38 FT
Bottom Elevation: 480.3

SUMMARY BORING LOG

Formation	Depth From	Depth To	Elevation From	Elevation To	Thickness
FILL: SOFT-FIRM, BRN, SILT & SILTY CLAY	0.0	9.1	518.3	509.2	9.1
LOOSE, BRN, SILTY SAND & SANDY SILT	9.1	16.5	509.2	501.8	7.4
LOOSE, BLK, SILTY SAND W/ CLAY VARIED	16.5	19.8	501.8	498.5	3.3
SOFT, GRAY, CLAYEY SILT	19.8	25.0	498.5	493.3	5.2
LOOSE, BLK, FN TO CRS SAND	25.0	31.5	493.3	486.8	6.5
LOOSE, BRN, FN TO SILTY SAND, FEW GRAY CLAY LENSES.	31.5	38.0+	486.8	480.3-	6.5+

BORING/WELL COMPLETION

Monitoring Well: X Piezometer: __ Grouted: __ Test Well: __
Pumping Well: __ Other (Describe): _____

WELL CONSTRUCTION

Casing

Type GALVANIZED/FLUSH JOINTS
Diameter 3"
Depth -25 to +2.5

Type _____
Diameter _____
Depth _____ to _____

Screen

Type 10 SLOT 5 FT LONG
Diameter 3"
From -30 To -25
Comments: WATER LEVEL AT 17 FT

Gravel Pack: -40 to -22
Grout: -22 to -2
Seal: -22 to -21

REMARKS

COULD NOT FLUSH ANY REVERT UP AND OUT OF HOLE

Engineer/Inspector: J.E. WRIGHT

BWL

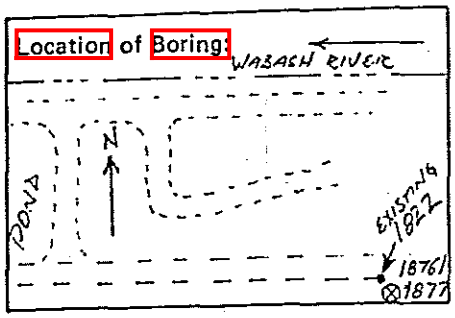
SOIL BORING LOG

HES HARZA ENVIRONMENTAL SERVICES, INC.

Sheet 1 of 2

PROJECT: 1919 D ELC

Location of Boring:



Water Depth: ____
Date: ____
Time: ____
Hole Depth: ____
Casing Depth: ____

Boring No.: T1876/1877 (FIRST ATTEMPT)

Feature: FLOOD PLANE - UNIT IIC

Coordinates: N 2,002 (est.)
E 515 (est.)

Ground Elevation: 528.2 (est.)

Casing Elevation: N/A

Total Depth: 40 FT

Bottom Elevation: 488.2

Date Started: 12-3-86 Time: 10:45A

Date Completed: 12-4-86 Time: 5:30P

Drilling Method (s): H.S. AUGER W/OUT PLUG TO 20', ROTARY (TRICONE) & REVERT

Hole/Casing Size (s): 12" H.S. (O.D.) / 3" FLUSH JOINT

Sampling Method (s): SPT 24" S.S. SAMPLER 2" O.D.

Sample Dimensions: 1.37" DIA Hammer Weight/Drop: 140 LB / 30"

Surface Conditions: TOWPATH (ROAD) & COLLECTOR DITCH - ROAD BASE & FILL

Date: ____ Checked By: ____ Logged By: ____ Drilling Contractor: ____

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
	1	1A	5-4	24	18		—		FILL: LOOSE, BROWN-GRAY-BLACK SAND & SANDY SILT W/ CRS SAND & ½" PEBBLES, HIGH % ORGANIC MATERIAL, STRONG CHEMICAL ODOR	MOIST-WET
	3	1B	4-4							
5	5.5	2	2-1 0-2	24	12					
	8	3	3-2 3-5	24	3					
10	10.5	4	1-1 2-2	24	6		ML-SM		7.5-12.3 LOOSE, BROWN & DARK GRAY SANDY SILT W/ 1-3" SILTY SAND LENSES FN TO CRS SAND, LOW TO MOD PLASTICITY (CLAY BINDER)	MOIST
	13	5	2-3 4-3	24	3					
15	15.5	6	2-2 3-3	24	12		SM		12.3-18.0 LOOSE BROWN SILTY SAND, FN TO CRS POORLY GRADED, SLIGHT CHEMICAL ODOR	WET-SATURATED
	18	7	4-4 5-4	24	18					
20	20.5	8	22-10 11-11	24	24		SM-SC		18.0-21.0 FIRM, BROWN SAND, VARIES FROM SILTY FN SAND TO CLAYEY, SILTY FN SAND	WET
	23	9	7-7 11-18	24	18		CH		21.0-22.5 STIFF, GRAY CLAY, HIGH PLASTICITY MOD TO HIGH TOUGHNESS & STRENGTH	MOIST BEGAN USING ROTARY BIT & REVERT @ 20'
25	25.5	10	14-19 25-22	24	22		SM-SC		22.5-30.0+ FIRM BROWNISH GRAY SILTY SAND CLAY % VARIES, FN GRAINED POORLY GRADED	MOIST
	28	11	16-18 24-22	24	22					
30		12	6-8 11-13	24	12					

SOIL BORING LOG

HESHARZA ENVIRONMENTAL SERVICES, INC.

Sheet 2 of 2

PROJECT: 1919 D ELC

Location of Boring:

Water Depth: _____ _____ _____
Date: _____ _____ _____
Time: _____ _____ _____
Hole Depth: _____ _____ _____
Casing Depth: _____ _____ _____

Drilling Method (s): _____

Hole/Casing Size (s): _____

Boring No.: 1876/18 (#22a (FIRST AM

Feature: _____

Coordinates: N _____

E _____

Ground Elevation: _____

Casing Elevation: _____

Total Depth: _____

Bottom Elevation: _____

Date Started: _____ Time: _____

Date Completed: _____ Time: _____

Sampling Method (s): _____

Sample Dimensions: _____ Hammer Weight/Drop: _____ / _____

Surface Conditions: _____

Date: _____ Checked By: _____ Logged By: _____ Drilling Contractor: _____

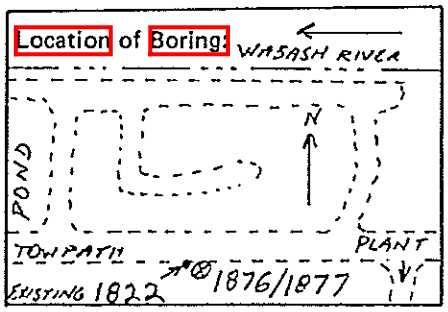
Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
30									NO SAMPLING BELOW 30 FT.	DRILLED FROM 30-40 FT W/ PLUG IN H.S. AUGER USING REVER
35										
40									E.O.B. AT 40 FT SINCE HOLE WAS STOPPED AT 40 FT RATHER THAN 50 FT. THE LOWER 20 FT WAS ALLOWED TO CAVE AND THE WELL WAS INSTALLED IN A NEW ADJACENT HOLE 3 FT AWAY.	COULD NOT FINISH HOLE TO 50 FT DUE TO FLOWING SAND.
45									WELL INSTALLATION: DRILLED NEW HOLE FOR WELL —	
50									WELL SCREEN -18 TO -13 SAND -20 TO -11 BENTONITE PELLETS -11 TO -10 VOLCLAY GROUT -10 TO -3	

SOIL BORING LOG

HESHARZA ENVIRONMENTAL SERVICES, INC.

Sheet 1 of 1

PROJECT: ELC 1919 D



Water Depth: FLOWING
Date: 12-11-86
Time: 07:30
Hole Depth: 20 FT
Casing Depth: 18 FT

* NEW HOLE N3 SAMPLED HOLE.

Boring No. T 1876 (22a)
Feature: FLOOD PLANE - UNIT
Coordinates: N 2,002.25
E 514.98
Ground Elevation: 528.2
Casing Elevation: 529.72
Total Depth: 20 FT
Bottom Elevation: 508.2

Date Started: 12-9-86 Time: 9:00a
Date Completed: 12-10-86 Time: 10:30A

Drilling Method (s): 12" H.S. AUGER TO 10 FT THEN 6" ROTARY TO 20 FT
Hole/Casing Size (s): 6IN. HOLE / 3" FLUSH JOINT CASING

Sampling Method (s): N/A SEE SHEET FOR 22a (SAMPLE
Sample Dimensions: — Hammer Weight/Drop: — / —
Surface Conditions: —

Date: ____ Checked By: ____ Logged By: J.E.Wright Drilling Contractor: TSC

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
5									SEE LOG FOR #22a	
10									WELL INSTALLATION: SCREEN -18 - -13 SAND / NATURAL BACKFILL -20 - -11 BENTONITE -11 - -10 VOLCLAY GROUT -10 - 3	DRILLED W/ROTARY BIT & REVERT FROM 10 - 20 FT.
15										STRONG SOLVENT SMELL FROM AUGER CUTTINGS.
20									E.O.B. @ 20 FT NOTICED LOW ARTESIAN FLOW ON 12-11-86 STRONG SOLVENT SMELL FROM WATER IN WELL.	

HARZA ENVIRONMENTAL SERVICES, INC.

T1876

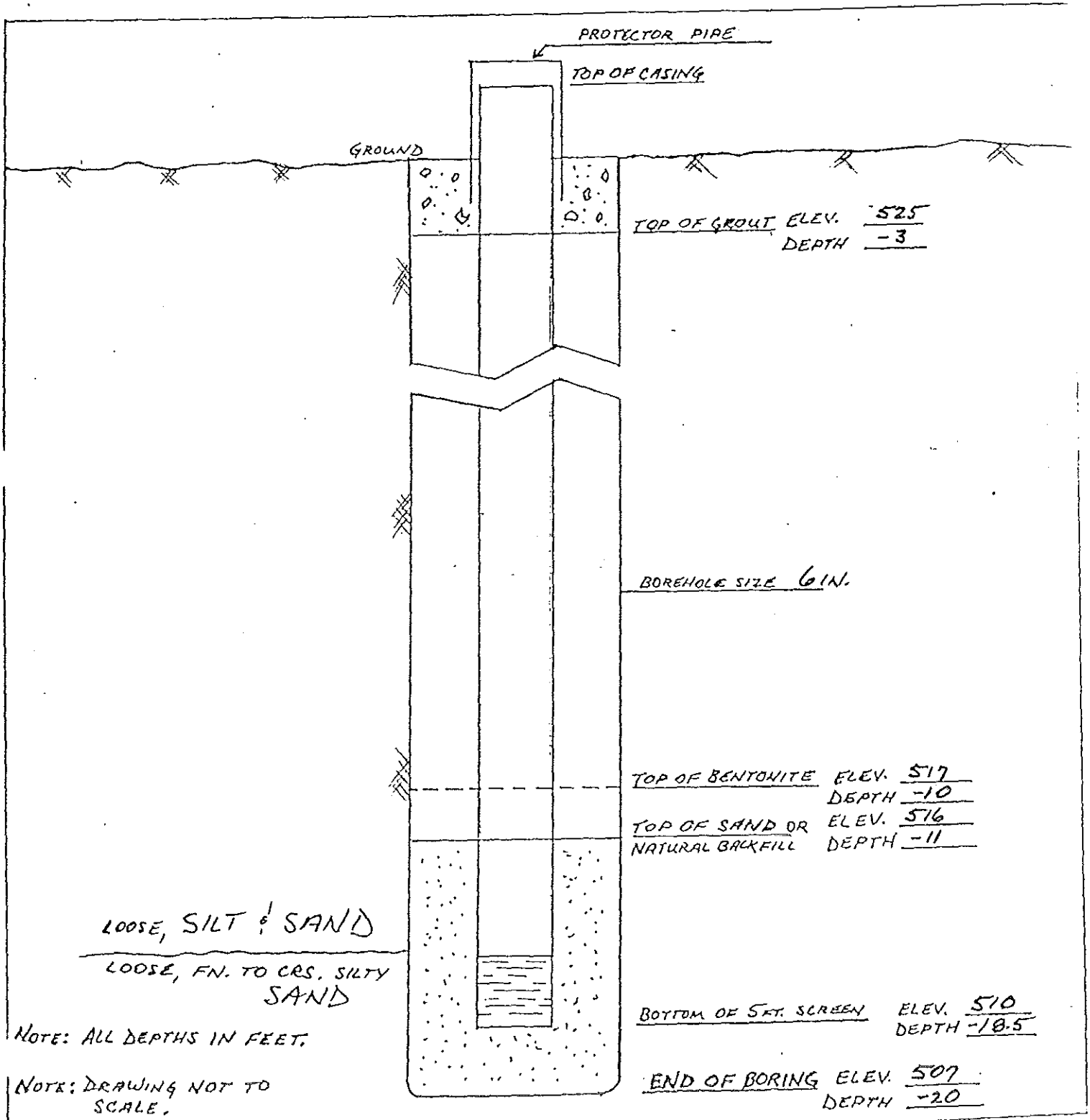
WELL CONSTRUCTION SKETCH

Project: ELC 1919 D

Well Number: 1876(224) SHALLOW

Coordinates: North 2,002.2450
East 514.9962

Elevations: Ground 528.2
T.O.C. 529.72



NOTE: ALL DEPTHS IN FEET.

NOTE: DRAWING NOT TO SCALE.

Engineer/Inspector: J.E. WRIGHT

HARZA ENVIRONMENTAL SERVICES, INC.

BORING/WELL COMPLETION REPORT

Project: 1919 D ELC

Boring/Well No: T 1876 (#22A)

Date: Started 12-9-86
Completed 12-10-86
Coordinates: North
East
Drilling Method: * 6" ROTARY (TRICONE)
Drilling Fluid: REVERT WHEN FLUSHED
Drilled Diameter: 12" 0-10'/6" 10-20'

Contractor: TSC
Purpose: MONITOR WELL
Ground Elevation: 528
T.O.C. Elevation: 530
Drilled Depth: 40'ET
Bottom Elevation: 488 FT

* SUMMARY BORING LOG FROM FIRST ATTEMPT

Formation	Depth From	Depth To	Elevation From	Elevation To	Thickness
FILL: BRN-GRAY-BLK, SAND & SANDY SILT	0.0	7.5	528	520.5	7.5
LOOSE, BRN-D.GRY, SAND SILT & SILTY SAND	7.5	12.3	520.5	515.7	4.8
LOOSE, BRN., SILTY SAND, FN-CRS	12.3	18.0	515.7	510.0	5.7
FIRM, BR-I, SAND & CLAYEY, SILTY FN SAND	18.0	21.0	510.0	507.0	3.0
STIFF, GRAY CLAY, HIGH PLAST & TOUGH	21.0	22.5	507.0	505.5	1.5
FIRM, BRN TO GRY, SILTY SAND, FN GRAINED	22.5	30.0 +	505.5	498 +	7.5

BORING/WELL COMPLETION

Monitoring Well: X Piezometer: __ Grouted: __ Test Well: __
Pumping Well: __ Other (Describe): _____

WELL CONSTRUCTION

Casing

Type GALVANIZED / FLUSH JOINTS
Diameter 3"
Depth -13 to +2

Type _____
Diameter _____
Depth _____ to _____

Screen

Type 5 FT. LONG, 10 SLOT
Diameter 3"
From -18 To -13

Gravel Pack: -20 to -11
Grout: -10 to -3
Seal: -11 to -10

Comments: WATER LEVEL AT SURFACE

REMARKS

THIS HOLE WAS DRILLED ABOUT 10 FT EAST OF FIRST ATTEMPT AT #22A. THE LOCK-BOX AND SAMPLE CAN WILL BE PLACED WHEN CLIENT DECIDES HOW TO DEAL WITH THE ARTESIAN FLOW.

Engineer/Inspector: T. E. WRIGHT

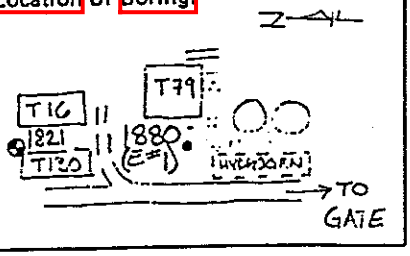
SOIL BORING LOG

HES HARZA ENVIRONMENTAL SERVICES, INC.

Sheet 1 of 3

PROJECT: ELI LILLY - TIPPECANOE

Location of Boring:



Water Depth: 64.60'TOC
Date: 6/30/88
Time: 1600
Hole Depth: 70'GLS
Casing Depth: 70.50'TOC

Drilling Method (s): 0~10' CFA AUGER 4"; 10'~ENE(70') 4" ROTARY W/REVERT

Hole/Casing Size (s): 6" BOREHOLE / 3" ID GALV. STEEL CASING

Boring No.: T1880
Feature: MAIN PLANT, #T79
Coordinates: N 1483.1
E 508.5
Ground Elevation: 609.7
Casing Elevation: 611.76
Total Depth: 70.0
Bottom Elevation: 539.7

Date Started: 6/22/88 Time: 1000
Date Completed: 6/23/88 Time: 0830

Sampling Method (s): SPT w/Split spoon for 24" on 2½'/5', HNU meter for V.O.C.

Sample Dimensions: 1.37x24" Hammer Weight/Drop: 140#/

Surface Conditions: Gravel parking lot near steep slope. Dru.

Drilling Contractor: TSC/TERRY E. Logged By: DDW Checked By: MMC Date: 5-19-89

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
							GP		0~½": Angular limestone gravel to 1½"	
5	.0 / .3	#1	7-7 22-9/4"	21"	12"		SP		6"~7': USDA sand. Yellow-brn loose SAND, v.fine~crs. Trace ¼" sb. rounded gravels, no fines. Very poorly graded	HNU=0.0 DAMP FILL UNIT I
10	.0	#2	8-18 29-24	24"	8"		SP		7'~26½': USDA gravelly sand. Y-brn mod. dense gravelly SAND, v.f.~crs, poorly~mod. graded. 15% rounded gravels to 1½", no fines.	HNU=0.0 DAMP
15	.0	#3	16-24 32-33	24"	18"		SP			HNU=trace MOIST Cobble fragments in spoon.
20	.0	#4	12-15 22-26	24"	18"		SP		} (slight size change in thin seam v.fine~fine, fewer gravels)	HNU=trace MOIST
25	.0	#5	23-16/5 5"/11"	22"	14"		SP			HNU=trace MOIST
	.0	#6	21-22 30-23	24	18"		SW-SP		26½'~46½': USDA gravelly loam sand (see next page for description)	HNU=trace MOIST

SOIL BORING LOG
(Continued)

HESHARZA ENVIRONMENTAL SERVICES, INC.

Sheet 2 of 3

PROJECT: ELI LILLY - TIPPECANOE Boring No.: T1880

Drilling Contractor: TSC / JERRY E Logged By: D D WALKER Checked By: Date:

Sampling Method(s): see page 1/3

Sample Dimensions: Hammer Weight/Drop: /

Surface Conditions:

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
35	.0	7	13-19 25-50	24"	14"		SW-SM		26½'~46½': USDA gravelly loamy sand. Y-med. brn dense gravelly SAND, v.fine~crs, mod. graded. 15% rounded~sbrounded gravels to 1". 10% silty fines, occasional cobbles. Local, slightly coarser seams.	HNU = trace MOIST
40	.0	*8	37-50/5"	11"	8"		SW-SM			
45	.0	*9	21-43 43-45	24"	16"		SW-SM			HNU = 0.0 MOIST
50	.0	*10	26-40 43-50	23"	20"		SP		46½'~51½': USDA Sand. lt. brn, dense fine SAND, v.f~fine, very poorly graded. No gravels or fines	HNU = trace MOIST
55	.0	*11	22-39 41-41	24"	24"		SW-SM		51½'~57': USDA gravelly loamy sand. Y-brn dense gravelly SAND, vf~crs mod graded. ~15% sbround gravel to 1", ~10~15% silt.	HNU = trace WET
60	.0	*12	19-40 45-50/5"	23"	23"		SP		57'~61½': USDA sand. Lt. brn, dense v.f SAND, very poorly graded Trace silt	← silt recovered on screen. HNU = 1.8 WET
65	.0	*13	17-50	10"	2"		SM-SC		61½'~66': USDA sandy clay loam - sandy loam. Dense, grey, clayey SAND, vf~med. 20% clay, 10% silt. Black stained ~crs, strong "chemical" odor	Poor SAMPLE (on cobble?) HNU = 11.0 WET
	.5	*14	24-44 48	16"	17"		SW-SM		66'~68': USDA grav. loamy sand. Y-brn, dense gravelly SAND, vf~crs. 1" sbround gravel. 10% M	HNU = 8.0 SATURATED
	.0	*15	21-25 24-50	24"	21"		CL		68'~EOB: USDA clay. Grey, v. dense, tough CLAY ~trace sand.	HNU = 3.0 UNIT EOB 70'

SOIL BORING LOG
(Continued)

HES HARZA ENVIRONMENTAL SERVICES, INC.

Sheet 3 of 3

PROJECT: ELI LILLY TIPPECANOE Boring No.: T 1880

Drilling Contractor: TSC (JERRY E) Logged By: D D WALKER Checked By: Date:

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log

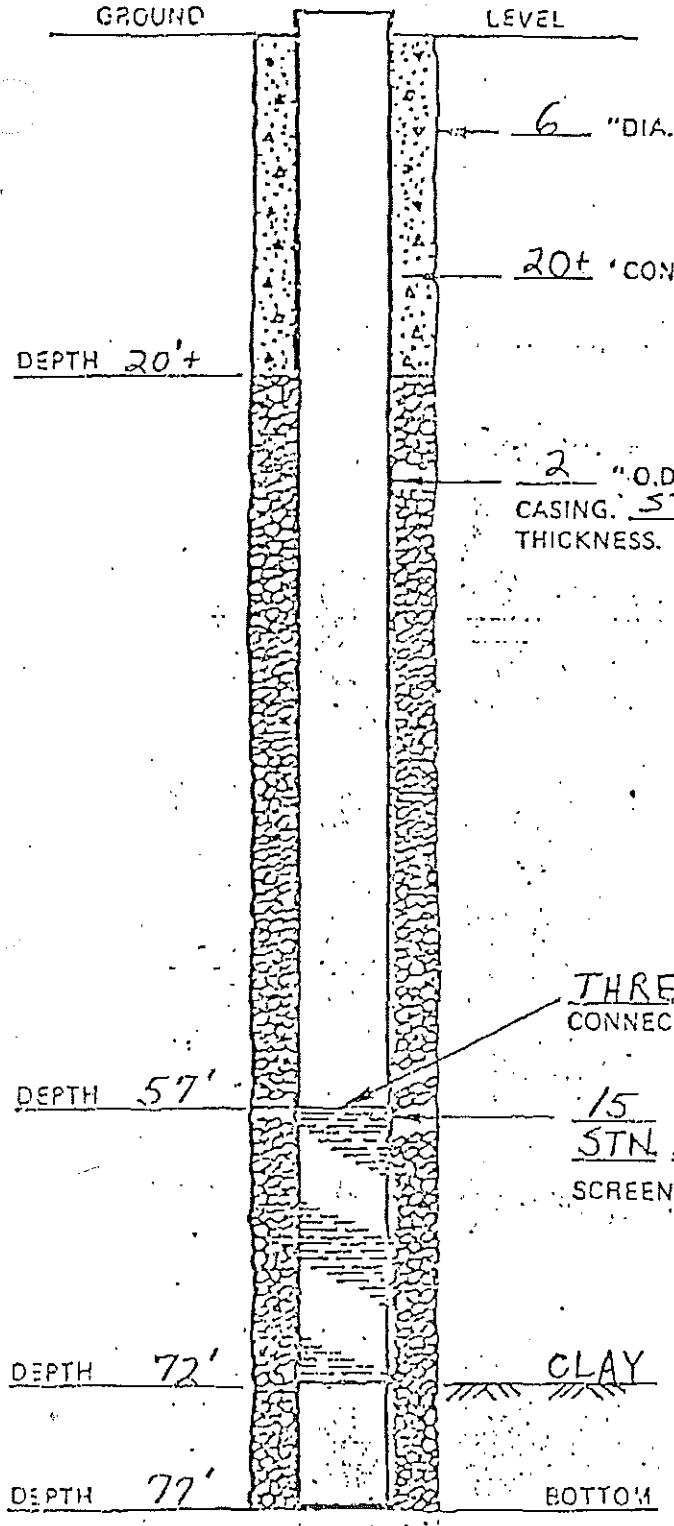
Sampling Method(s): see page 1/3

Sample Dimensions: _____ Hammer Weight/Drop: _____ / _____

Surface Conditions: _____

SOIL DESCRIPTION	REMARKS
Well Construction Notes 6" ROTARY REAM TO 68' 2' exposed casing, +2¾" of threads. Concrete 0 ~ 2½' Bentonite Pellet 2½ ~ 3½' VOLCLAY 3½ ~ 55' Bentonite Pellet 55' ~ 58' Silica Sand & 58' ~ 68' 10% Natural cave 5' of 10-slot SS screen 63'~68' EOC 68' ≈ 542' EOB 70' ≈ 540	

CASING EXTENDS 2 FEET ABOVE GROUND LEVEL



JOB NO. 36-3319

DISTRICT Indianapolis

LOCATION Eli Lilly + Co. Tippecanoe Labs

COUNTY Tippecanoe

TOWNSHIP

SECTION T R

STATE Indiana

CASING TALLY — WELDED / THREADED

	FT.	IN.
BOTTOM		
TOP		
TOTAL		

STATIC LEVEL 65'

PUMPED G.P.M. AT FEET PUMPING LEVEL AFTER HOURS

TYPE OF RIG Auger DRILLER Melling DATE COMPLETED 5-11-89

NOTE: ALL DEPTHS MEASURED FROM GROUND LEVEL. NOT TO SCALE.

Eli Lilly and Co. Tippecanoe Labs Monitor Well No. 1908

LAYNE-NORTHERN

INDIANAPOLIS, IND. • MISHAWAKA, IND. • LANSING, MICH.

DRAWING NUMBER SC-1

CASING EXTENDS 2 FEET ABOVE GROUND LEVEL

JOB NO. 36-3319

DISTRICT Indianapolis

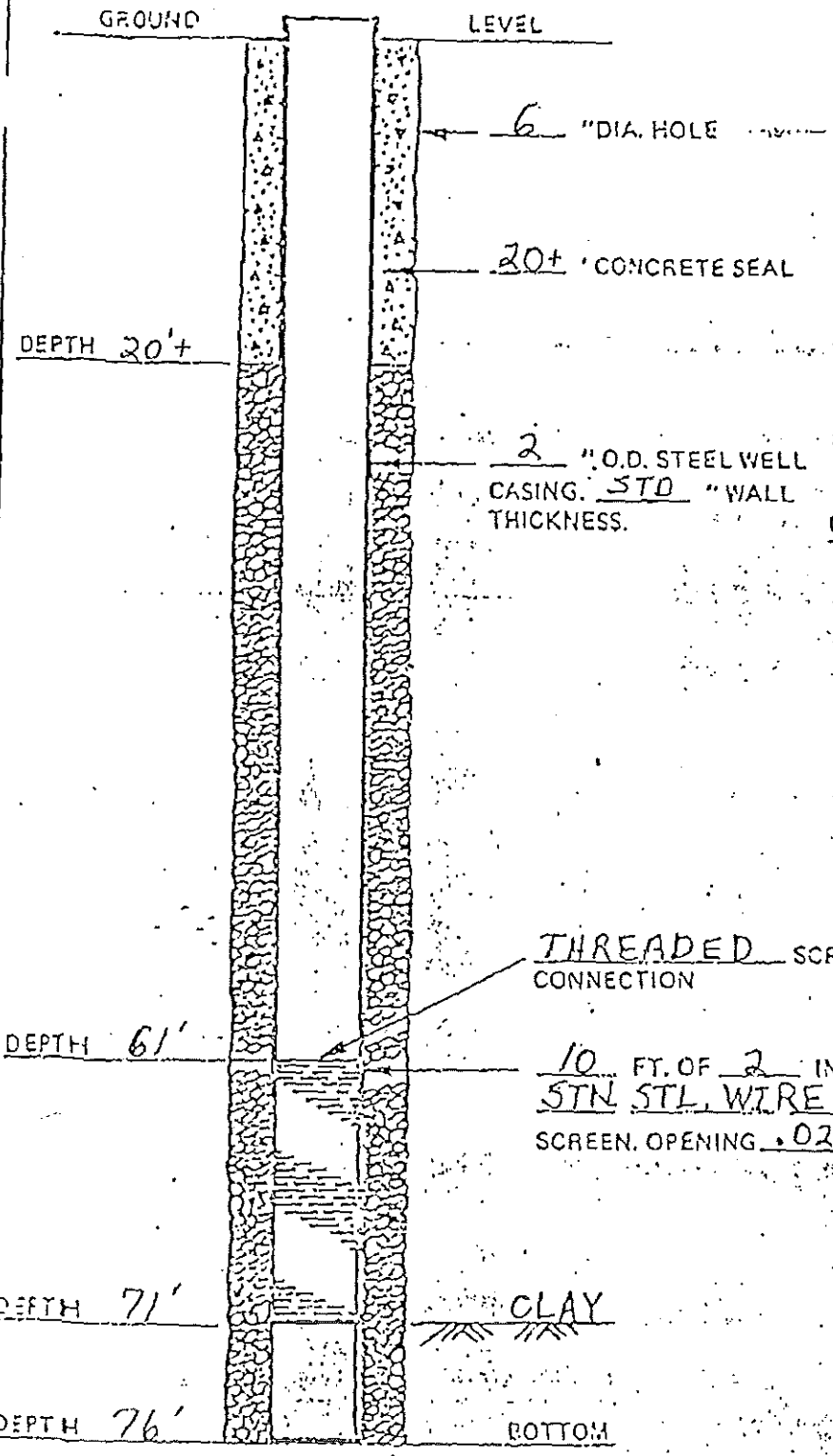
LOCATION Eli Lilly + Co.
Tippecanoe Labs

COUNTY Tippecanoe

TOWNSHIP

SECTION T R

STATE Indiana



CASING TALLY — WELDED / THREADED

	FT.	IN.
BOTTOM		
TOP		
TOTAL		

STATIC LEVEL

PUMPED G.P.M. AT FEET PUMPING LEVEL AFTER HOURS

TYPE OF RIG Auger DRILLER Melling DATE COMPLETED 5-12-89

NOTE: ALL DEPTHS MEASURED FROM GROUND LEVEL. NOT TO SCALE.

Eli Lilly and Co. Tippecanoe Labs Monitor Well No. 1909

LAYNE-NORTHERN

INDIANAPOLIS, IND. • MISHAWAKA, IND. • LANSING, MICH.

DRAWING NUMBER SC-1

Building T52 Tank Farm Monitoring Wells

Well	ACETONE (ppm)	ACN (ppm)	BENZENE (ppm)	DEA (ppm)	ETHER (ppm)	IPA (ppm)	MeCL2 (ppm)	THF (ppm)	TOLUENE (ppm)	TOTAL VOC'S (Percent)
T1905	2283	15	105	4530	101	2428	1250	3022	425	1.42%
T1907	22	5	48	355	98	36	287	149	8	0.10%
T1908	ND	ND	6	148	23	ND	26	ND	5	0.02%
T1909	16	ND	20	3178	6	197	166	46	52	0.37%
T1910	202	5	17	2968	6	104	319	248	13	0.39%

J. H. Sunderlin
4/23/90

ERM Environmental Resources Management, Inc.

GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Soil Boring and Well Installation	71226.02.01	1 of 11	T2001

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1723.37; E231.69	Photo Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
02/28/01	03/02/01	Reynolds	Mobile CME 95	9-Inches	109'

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	ELEV.TOP CASING	GROUND ELEV.	DEPTH/ELEV. GROUND WATER	DEPTH/ELEV. TOP OF ROCK
/			616.79	614.10	▼ 73' bgs / 541.10	NOT ENCOUNTERED

SAMPLE DEVICE	DRILL CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY
4 1/4" x 5' Split Spoon Sampler		Christine Tonn

SAMPLES/R.CORE: Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	CONTAMINANT SCREENING: Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations	LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
								5				The casing and ground surface elevations were measured using Lilly plant datum. The northing and easting coordinates are based on the Lilly plant grid.

ERM Environmental Resources Management, Inc.

GEOLOGIC DRILL LOG	PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
	Soil Boring and Well Installation	71226.02.01	2 of 11	T2001

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1723.37; E231.69	Photo Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
02/28/01	03/02/01	Reynolds	Mobile CME 95	9-Inches	109'

Continued

SAMPLES/R.CORE: Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count / RQD (%)	CONTAMINANT SCREENING: Sample Scan* (Vppm)	Headspace** (Vppm)	Observations	LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
								10				
								15				
							-18-					Blind drilled to 18' BGS
11:30	0.83	5			0.8	pH=8.70					18.0-28.0': GRAVELLY SAND: 7.5YR 4/3 brown, 30% angular to subround Gravel to 2" diameter; 50% medium to coarse Sand; 20% Silt; moderately friable, moist.	

ERM Environmental Resources Management, Inc.

GEOLOGIC DRILL LOG	PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
	Soil Boring and Well Installation	71226.02.01	3 of 11	T2001

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1723.37; E231.69	Photo Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
02/28/01	03/02/01	Reynolds	Mobile CME 95	9-Inches	109'

Continued

SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations						
								20				
11:30	0.83	5			0.8	pH=8.70						
											As Above, 7.5YR 8/3 lt. brown, 10% subround to round Gravel; 80% Sand; friable, moist.	
								25				
11:48	1.0	5			0.8	pH=8.78						
							-28-				28.0-43.0': SILT; 2.5Y 4/3 olive brown, 5% fine Sand; 95% Silt; friable, dry.	
13:20	4.0	5			0.8	pH=7.82						

ERM Environmental Resources Management, Inc.

GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Soil Boring and Well Installation	71226.02.01	4 of 11	T2001

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1723.37; E231.69	Photo Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
02/28/01	03/02/01	Reynolds	Mobile CME 95	9-Inches	109'

Continued

SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations						
					0.5			30			As Above, 10% Sand; 90% Silt.	
13:20	4.0	5				pH=7.82						
					0.5						As Above, 2.5Y 5/6 lt. olive brown, friable, slightly moist.	
					0.8			35				
13:35	4.0	5				pH=8.05						
					0.8							
13:48	3.5	5			0.8	pH=8.31						

ERM Environmental Resources Management, Inc.

GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Soil Boring and Well Installation	71226.02.01	5 of 11	T2001

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1723.37; E231.69	Photo Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
02/28/01	03/02/01	Reynolds	Mobile CME 95	9-Inches	109'

Continued

SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations						
					0.7			40			As above, 2" to 3" lenses with up to 10% clay.	
13:48	3.5	5				pH=8.31						
					0.5		-43-				43.0-44.25': SILT LOAM; 2.5Y 5/4 lt. olive brown, 20% medium to fine Sand; 80% Silt; friable, slightly moist.	
							-44.2-				44.25-53.58': SILT; 2.5Y 5/4 lt. olive brown, 10% fine Sand; 90% Silt; friable, slightly moist.	
					0.4			45				
14:10	4.5	5				pH=7.97						
					0.5						As Above, small patches of Silt Loam, 10% fine Sand; 70% Silt; 20% Clay; veins of Fe staining.	
											As above, 2.5Y 6/5 lt. olive brown, medium to fine Sand lenses throughout bottom 1', friable, slightly moist.	
14:25	3.0	5			0.7	pH=8.71						

ERM Environmental Resources Management, Inc.

GEOLOGIC DRILL LOG	PROJECT/TASK Soil Boring and Well Installation	PROJECT NUMBER 71226.02.01	SHEET NO. 6 of 11	HOLE NUMBER T2001

SITE Eli Lilly, Shadeland, IN	COORDINATES N 1723.37; E231.69	CONTAMINANT SCREENING NOTES Photo Ionization Detector

BEGUN 02/28/01	COMPLETED 03/02/01	DRILLER Reynolds	DRILLING EQUIPMENT Mobile CME 95	BORING DIA. 9-Inches	DEPTH (FT) 109'

Continued

SAMPLES/R.CORE				CONTAMINANT SCREENING								
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations	LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
								50				
					0.5							
14:25	3.0	5				pH=8.71						
					0.0						As Above, 7.5YR 6/4 lt. brown, 7% subround to round Gravel; 10% fine Sand; 83% Silt; friable, slightly moist.	
							-53.6-				53.58-55.0': SILT LOAM: 7.5YR 6/4 lt. brown, 30% fine Sand; 70% Silt; friable, slightly moist, Fe staining.	
					0.1			55			55.0-58.0': SANDY LOAM: 7.5YR 6/4 lt. brown, 70% fine to coarse Sand; 30% Silt; friable, slightly moist.	
14:41	4.5	5				pH=8.41						
					0.0							
											58.0-59.75': LOAMY SAND: 10YR 6/4 lt. yellowish brown, 85% fine Sand; 15% Silt; friable, slightly moist.	
14:55	4.5	5			0.0	pH=7.98					As Above, trace subround to round Gravel, patches of Fe staining.	
							-59.7-				59.75-63.0': SILT: 10YR 5/6 yellowish brown, 10% fine Sand; 90% Silt; slightly friable, moist.	

ERM Environmental Resources Management, Inc.

GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Soil Boring and Well Installation	71226.02.01	7 of 11	T2001

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1723.37; E231.69	Photo Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
02/28/01	03/02/01	Reynolds	Mobile CME 95	9-Inches	109'

Continued

SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Observations						
					0.0			60				
14:55	4.5	5				pH=7.96						
					0.0		-63-				63.0-63.75': SAND; 10YR 6/4 lt. yellowish brown, 80% fine Sand; 20% Silt; soft, friable, slightly moist.	
							-63.7-				63.75-68.0': SANDY LOAM; 10YR 5/4 yellowish brown, 50% Silt, 50% fine Sand; slightly moist.	
					0.0			65				
15:15	4.25	5				pH=7.93					As above, 10% subround to round Gravel to 1" diameter; 45% fine Sand; 45% Silt; moist.	
					0.1							
							-68-					
							-68.2-				68.0-68.18': GRAVELY SAND; 10YR 5/6 brown, 20% subround to round Gravel; 80% coarse Sand; friable, moist.	
											68.18-69.0': GRAVELY SANDY LOAM; 10YR 5/3 brown, 30% subround to round Gravel; 50% fine Sand; 20% Silt; moist.	
15:35	4.0	5			0.1	pH=8.48						

ERM Environmental Resources Management, Inc.

GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Soil Boring and Well Installation	71226.02.01	8 of 11	T2001

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1723.37; E231.69	Photo Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
02/28/01	03/02/01	Reynolds	Mobile CME 95	9-Inches	109'

Continued

SAMPLES/R.CORE				CONTAMINANT SCREENING							
Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count / RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations	LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
								70				
					0.0		-71-					
15:35	4.0	5				pH=8.48					71.0-73.0': GRAVELY SAND; 10YR 8/4 lt. yellowish brown, 40% subround to round Gravel; 50% fine to coarse Sand; 10% Silt, friable, moist.	
					10.1		-73-				73.0-75.91': SAND; 10YR 5/3 brown, 95% coarse to fine Sand; 5% Silt; soft, wet.	Wet at 73'
											As Above, <10% subround to round gravel to 2" diameter, poorly sorted; wet.	
					18.3			75				
16:15	4.08	5				pH=8.47	-75.9-				75.91-76.24': SANDY GRAVEL; 10YR 5/4 yellowish brown, 80% round Gravel; 35% fine to coarse Sand; wet.	
							-76.5-				76.24-76.5': GRAVELY SAND; 10YR 5/4 yellowish brown, 30% round Gravel; 80% coarse Sand; wet.	
					25.2		-76.8-				76.5-76.83': SILT LOAM; 10YR 5/3 brown, 80% Silt, 40% fine, well sorted Sand; soft, wet.	
											76.83-78.0': GRAVELLY SAND; 10YR 4/3 brown, 35% subround to round Gravel, 80% fine to coarse Sand; 5% Silt; Fe staining in patches, wet.	
							-78-				78.0-82.5': GRAVELLY SAND; mottled 10YR 2/2 very dark brown, 2.5Y 4/4 olive brown, and 10YR 4/3 brown, 25% subangular to round Gravel; 75% m-c Sand; 5% Silt; odor, staining, wet.	
10:15	2.75	5										Geotech samp 79-81'

ERM Environmental Resources Management, Inc.

GEOLOGIC DRILL LOG	PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
	Soil Boring and Well Installation	71226.02.01	9 of 11	T2001

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1723.37; E231.69	Photo Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
02/28/01	03/02/01	Reynolds	Mobile CME 95	9-Inches	109'

Continued

SAMPLES/R.CORE: Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count / RQD (%)	CONTAMINANT SCREENING: Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations	LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
10:15	2.75	5						80				Ground water sample 81'
					41.3		-82.5-				82.5-83.0': SILT LOAM; 2.5Y 4/1 dark grey, 20% medium Sand; 80% Silt; odor detected, staining, wet.	
							-83-					Geotech sample 83-84'
11:20	3.0	5			9.4			85			83.0-89.0': SAND; 2.5Y 4/1 dark grey, 95% fine to medium, wet sorted Sand; 5% Silt; odor detected, staining, wet.	
					10.9							
12:10	2.75	5			35.8		-89-				89.0-90.0': SANDY LOAM; 2.5Y 3/1 verk dark grey, 15% subround to round Gravel; 80% m-c Sand; 5% Silt, odor, staining, wet.	
								90				

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GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Soil Boring and Well Installation	71226.02.01	10 of 11	12001

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1723.37; E231.69	Photo Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
02/28/01	03/02/01	Reynolds	Mobile CME 95	9-Inches	109'

Continued

SAMPLES/R.CORE: Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count / RQD (%)	CONTAMINANT SCREENING: Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations	LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
							-90.2-	90			90.0-90.16': SANDY GRAVEL: 2.5Y 3/1 very dark grey, 60% subround to round Gravel; 35% m-c Sand; 5% Silt; odor, staining, wet.	
					8.4						90.16-93.0': SILT LOAM; mottled 10YR 3/3 dark brown and 10YR 2/1 black, 5% subround to round Gravel; 25% m. Sand; 60% Silt, 10% Clay, stiff, sl. moist.	
12:10	2.75	5									As Above, 2.5Y 3/1 v. dark grey, 15% f. Sand; 85% Silt; odor, staining, wet.	
					5.9		-93-				93.0-95.5': SAND; 2.5 3/1 very dark grey, 30% subround to round Gravel; 65% f-c Sand; 5% Silt, odor, wet.	
					7.0			95				
14:00	2.5	5					-95.5-				95.5-95.83': SILT LOAM; mottled 2.5Y 4/1 dark grey and 2.5Y 4/3 olive brown, 5% round Gravel; 20% f. Sand; 75% Silt; stiff, odors, staining, slightly moist.	
					2.0						95.83-98.0': LOAMY SAND; 2.5Y 5/2 grey brown, <1% round Gravel; 80% fine Sand; 20% Silt; soft, odors, wet.	
							-98-					Geotech sample 98-103'
15:12	3.0	5			8.4							

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GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Soil Boring and Well Installation	71226.02.01	11 of 11	T2001

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1723.37; E231.69	Photo Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
02/28/01	03/02/01	Reynolds	Mobile CME 95	9-Inches	109'

Continued

SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations						
								100			98.0–103.0': SAND: 10YR 3/1 very dark grey, 99% medium, well sorted Sand; 1% Silt; very unconsolidated, staining, strong odors, wet.	
15:12	3.0	5			8.2							
							-103-				103.0–107.25': SILT LOAM: 2.5Y 3/1 very dark grey, 40% medium Sand; 60% Silt; staining, odor, wet.	
					7.6			105				
10:15	1.0	5				pH=8.92						Ground water sample 106'
					8.9		-107.2-				107.25–108.0': SILT LOAM: 2.5Y 3/1 dark grey, 30% fine Sand; 55% Silt, dense; 15% Clay, stiff; odor, slightly moist.	Geotech sample 107–108'
							-108-				END OF BORING AT 108' BGS.	
								110				

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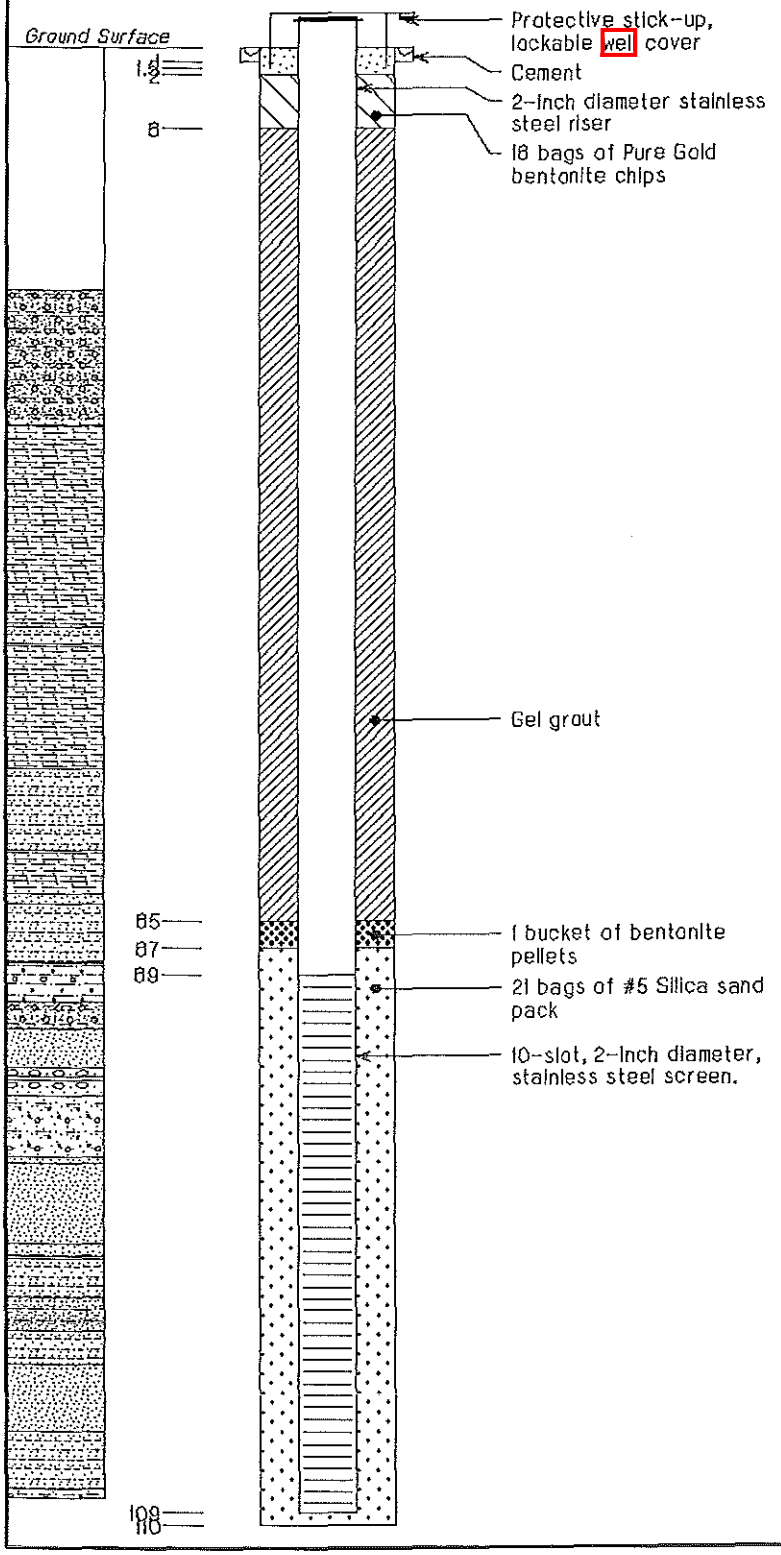
WELL CONSTRUCTION LOG

PROJECT/TASK: Soil Boring and Well Installation

PROJECT NUMBER: 71226.02.01

WELL NUMBER: 2001



Associated Soil Boring: 2001

City: Shadeland

County and State: Tippecanoe, IN

Ground Surface Elevation: 614.10

Measuring Point Elevation: 616.79

☒ Surveyed ☐ Estimated

Installation Date (s): 02/28/01-03/02/01

Drilling Method: Mobile CME 95

Drilling Contractor: Reynolds

Drilling Fluid: none

Development Technique (s) / Dates

Developed well using a Grundfos Redi-Flo2 Pump

March 2001

Fluid Loss During Drilling (gals)

Water Removed During Development (gals)

Static Water Level Depth (feet)

Date Water Level Measured

Well Purpose: Monitoring Well/Piezometer

Remarks: N 1723.37; E 231.69

The casing and ground surface elevations were measured using Lilly plant datum. The northing and easting coordinates are based on the Lilly plant grid.

Prepared By: Christine Tonn

Location: Vernon Hills

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GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Soil Boring and Well Installation	71226.02.01	1 of 10	T2002

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1299.01; E150.94	Photo Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
03/09/01	03/21/01	Reynolds	Mobile CME 95	9-Inches	99'

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	ELEV.TOP CASING	GROUND ELEV.	DEPTH/ELEV. GROUND WATER	DEPTH/ELEV. TOP OF ROCK
/			613.21	611.20	▼ 60' bgs / 551.20	NOT ENCOUNTERED

SAMPLE DEVICE	DRILL CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY
4 1/4" x 5' Split Spoon Sampler		Christine Tonn

SAMPLES/R.CORE				CONTAMINANT SCREENING								
Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count / RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations	LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
								5				The casing and ground surface elevations were measured using Lilly plant datum. The northing and easting coordinates are based on the Lilly plant grid.

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GEOLOGIC DRILL LOG	PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
	Soil Boring and Well Installation	71226.02.01	2 of 10	2002

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1299.01; E150.94	Photo Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
03/09/01	03/21/01	Reynolds	Mobile CME 95	9-Inches	99'

Continued

SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count / RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations						
								10				
								15				Blind drilled to 19' BGS
							-19-					
15:00	2.5	5			1.0	pH=7.45	-19.5-				19.0-19.5': GRAVELLY SAND: 10YR 5/6 yellow brown, 30% angular to subround Gravel; 65% f-c Sand; to 1/2" diameter; 5% Silt; loose, sl. moist.	
											19.5-20.75': SAND: 10YR 6/4 light yellowish brown, 7% Gravel, 80% m-c Sand; 3% Silt; very loose, slightly, moist.	

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GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Soil Boring and Well Installation	71226.02.01	3 of 10	T2002

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1299.01; E150.94	Photo Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
03/09/01	03/21/01	Reynolds	Mobile CME 95	9-Inches	99'

Continued

SAMPLES/R.CORE: Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count / RQD (%)	CONTAMINANT SCREENING: Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations	LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
					1.0		-20.7-	20				
											20.75-24.42': GRAVELY SAND: 10YR 5/4 yellow brown, 30% Gravel to 1" diameter; 60% f-c Sand; 5% Silt.	
15:00	2.5	5				pH=7.45						
					2.0							
					2.0			25				
							-25.8-				24.42-25.5': SAND: 10YR 8/4 light yellowish brown, 99% f-m, well sorted Sand; 1% Silt; band of Fe staining up to 1/4" thick, sl. moist.	
15:15							-26.2-				25.5-26.25': SAND: 10YR 7/3 very pale brown, 10% subround to round Gravel; 87% fine to coarse, poorly sorted Sand; 3% Silt; moist.	
	3.25	5				pH=8.13					26.25-29.0': SAND: 10YR 8/3 pale brown, 99% fine, well sorted Sand; 1% Silt; moist.	
					0.0							
							-29-					
15:25	2.5	5			1.0	pH=8.44					29.0-34.0': GRAVELY SAND: 10YR 5/6 yellowish brown, 25% angular to subround Gravel; 72% medium to coarse Sand; 3% Silt; loose, moist.	

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GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Soil Boring and Well Installation	71226.02.01	4 of 10	2002

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1299.01; E150.94	Photo Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
03/09/01	03/21/01	Reynolds	Mobile CME 95	9-Inches	99'

Continued

SAMPLES/R.CORE: Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count / RQD (%)	CONTAMINANT SCREENING: Sample Scan* (Vppm)	Headspace** (Vppm)	Observations	LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
								30				
					1.0							
15:25	2.5	5				pH=8.44						
					0.0							
							-34-				Gravel content increases with depth. 14% Gravel.	
					0.0			35				
15:40	3.33	5				pH=9.00						
					1.5							
15:45	2.5	5			0.0	pH=8.40						

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GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Soil Boring and Well Installation	71226.02.01	5 of 10	T2002

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1299.01; E150.94	Photo Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
03/09/01	03/21/01	Reynolds	Mobile CME 95	9-Inches	99'

Continued

SAMPLES/R.CORE: Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count / RQD (%)	CONTAMINANT SCREENING: Sample Scan* (Vppm)	Headspace** (Vppm)	Observations	LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
					0.0		-40.9	40			40.0–40.92': GRAVEL; 7.5YR 5/4 brown, 95% subround to round Gravel; 5% medium to coarse Sand; Fe staining, moist. As above, Gravel to 2" diameter.	
15:45	2.5	5			1.75	pH=8.40					40.92–44.0': SAND; 7.5YR 4/3 brown, 7% subround to round Gravel; 93% coarse, poorly sorted Sand; 1% Silt; loose, moist.	
					1.8		-44				44.0–44.33': GRAVEL; 7.5YR 7/6 and 6/6 reddish yellow, and 7.5YR 4/3 brown, 100% angular to round Gravel; moist.	
							-44.3				44.33–45.58': SANDY GRAVEL; 10YR 8/4 light yellowish brown, 78% round Gravel; 20% f-m Sand; loose, moist.	
							-45.8	45			45.58–46.83': SAND; 10YR 5/2 grayish brown, 96% f-m Sand; 4% Silt; moist.	
15:55	2.5	5			2.0	pH=8.20					45.83–49.0': SANDY LOAM; 10YR 4/1 dark gray, 60% fine Sand; 40% Silt; bands of 10YR 3/1 very dark gray staining, odor.	
16:40	5.0	5			2.0	pH=7.85	-49				49.0–40.08': SILT; 2.5Y 5/2 grayish brown, 4% f. Sand; 96% Silt; 4 mm 2.5Y 2.5/1 black at bottom, moist.	
							-49.7					
							-49.8					

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GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Soil Boring and Well Installation	71226.02.01	6 of 10	T2002

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1299.01; E150.94	Photo Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
03/09/01	03/21/01	Reynolds	Mobile CME 95	9-Inches	99'

Continued

SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations						
					2.0			50			50.08–50.5': SAND; black, 98% f,, wel sorted Sand; 4% Silt; odor, moist.	
							–50.5–				50.5–52.08': SILT; banded 2.5Y 6/3 light yellowish brown, black and 2.5Y 3/1 very dark gray, 2% f. Sand; 98% Silt; cohesive, dark bands 2mm to 1" thick, moist.	Soil sample 51.5–53'
16:40	5.0	5				pH=7.65	–52.1–					
					35.0						52.08–52.91': SAND; banded black, 2.5Y 5/1 gray, and 5Y 7/1 light gray, m. wel sorted Sand, bands from 5 mm to 3", moist.	
							–52.9–				52.91–54.0': SILT; 2.5Y 6/3 light yellow brown, 95% Silt, 5% f. Sand, cohesive, moist.	
							–54–				1/2" black, fine Sand lens, slightly cohesive, odor, moist.	
											54.0–55.0': INTERBEDDED SAND AND LOAMY SAND; Sand 2.5Y 4/1 dark gray and Loamy Sand 2.5Y 2.5/1 black; SAND–98% m., wel sorted Sand; 2% Silt; LOAMY SAND–80% m. Sand, well sorted Sand and 20% Silt, moderately moist, lamination, cross bedding, in the Sand, beds from 2 mm to 1", odor.	
					25.0		–55–	55			55.0–56.5': SAND; mottled 2.5Y 4/1 dark gray and 2.5Y 7/6 yellow, 97% f–m Sand; 3% Silt; loose, slightly moist, slight odor.	
8:10	4.5	5				pH=7.48	–56.5–				56.5–61.08': SILT; 2.5Y 6/4 light yellow brown, 15% Sand; 85% Silt, dense; cohesive, slight odor, slightly moist.	
					19.0							
8:30	4.0	5			10.0	pH=7.64						

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GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Soil Boring and Well Installation	71226.02.01	7 of 10	2002

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1299.01; E150.94	Photo Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
03/09/01	03/21/01	Reynolds	Mobile CME 95	9-Inches	99'

Continued

SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations						
								60			~~As above, 95% Silt; 5% Sand; odor, wet.~~	~~Wet at 80'~~
					10.0		-81.1				81.08–81.83': SAND: mottled 2.5Y 6/3 light yellow brown, 2.5Y 5/4 light olive brown, and 2.5Y 3/1 very dark gray, 7% Gravel to 1/4" diameter; 93% m–c Sand; moist.	
							-81.8					
8:30	4.0	5				pH=7.84	-82.1				81.83–82.08': SILT: banded 2.5Y 4/2 dark grayish brown and 2.5Y 3/1 very dark gray, <1% Sand; 99% Silt; slight odor, wet.	
					3.0						82.08–84.0': SAND: 2.5Y 2/1 black, 2% subround to round Gravel; 98% m–c Sand; odor, wet.	
							-84					
								65			84.0–89.0': GRAVELLY SAND: 2.5Y 2.5/1 black, 20% Gravel; 80% medium to coarse, poorly sorted Sand; loose, odor, wet.	
8:50	0.75	5			0.0	pH=7.08						
							-89				89.0–94.0': SAND: 2.5Y 2.5/1 black, 99% f–m, poorly sorted Sand; 1% Silt; loose, strong odor, wet.	Ground water sample 89'
13:15	2.5	5			10.0	pH=8.70						

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GEOLOGIC DRILL LOG	PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
	Soil Boring and Well Installation	71228.02.01	8 of 10	2002

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1299.01; E150.94	Photo Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
03/09/01	03/21/01	Reynolds	Mobile CME 95	9-Inches	99'

Continued

SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count / RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations						
								70				
13:15	2.5	5			10.0	pH=8.70						
												No Recovery 74'-84'
								75				
13:32	0	5										
14:10	0	5										

ERM Environmental Resources Management, Inc.

GEOLOGIC DRILL LOG	PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
	Soil Boring and Well Installation	71226.02.01	9 of 10	2002

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1299.01; E150.94	Photo Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
03/09/01	03/21/01	Reynolds	Mobile CME 95	9-Inches	99'

Continued

SAMPLES/R.CORE: Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count / RQD (%)	CONTAMINANT SCREENING: Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations	LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
								80				Ground water sample 81'
14:10	0	5										
								85			84.0-94.0': SAND: 2.5Y 3/1 very dark gray, 95% fine Sand; 5% Silt; loose, soft, very strong odor, wet.	
8:10	0.5	5			5.2	pH=7.18						
8:45	2.5	5			32.0	pH=10.02						

ERM Environmental Resources Management, Inc.

GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Soil Boring and Well Installation	71226.02.01	10 of 10	T2002

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1299.01; E150.94	Photo Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
03/09/01	03/21/01	Reynolds	Mobile CME 95	9-Inches	99'

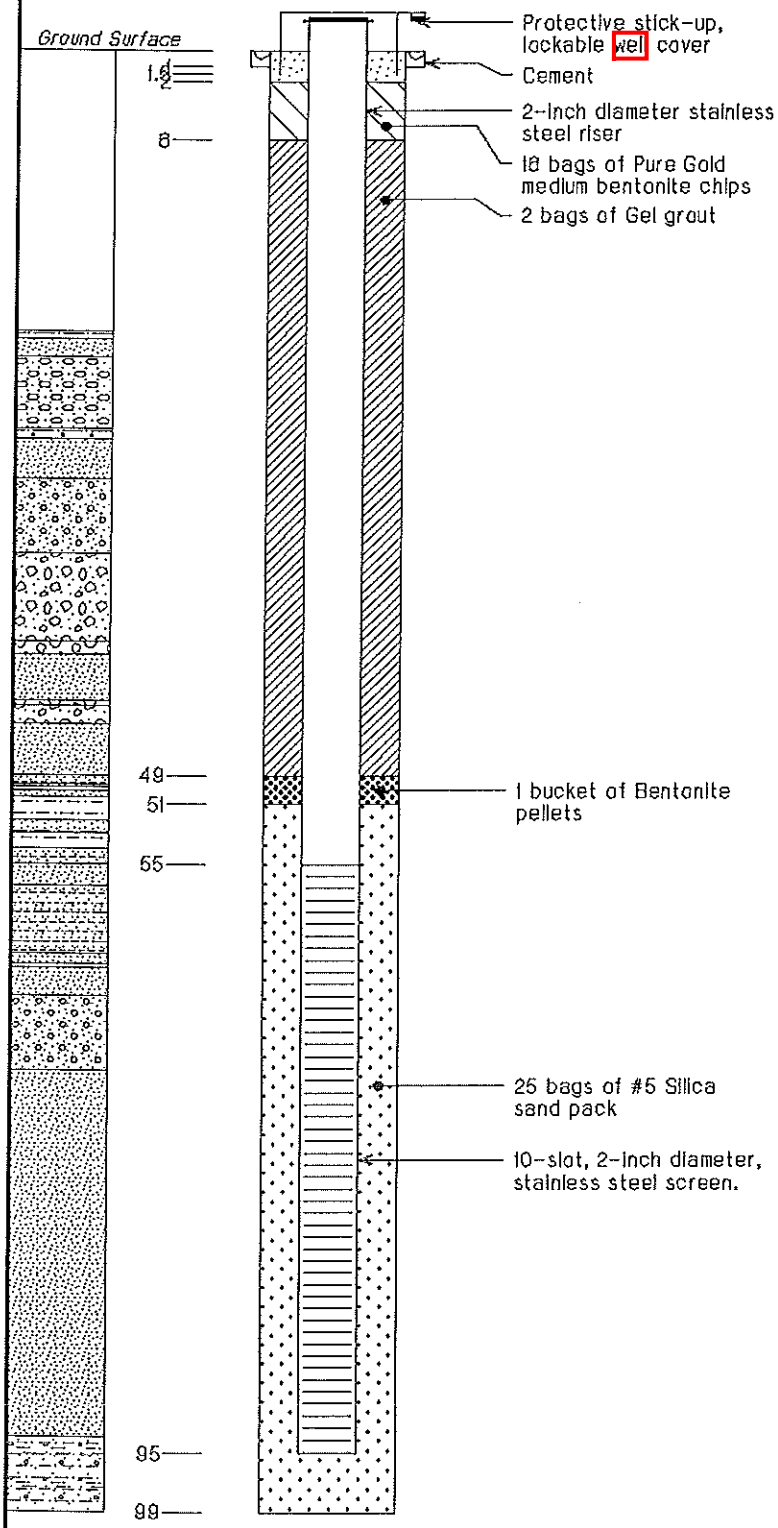
Continued

SAMPLES/R.CORE: Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count / RQD (%)	CONTAMINANT SCREENING: Sample Scan* (Vppm)	Headspace** (Vppm)	Observations	LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
					32.0			90				
8:45	2.5	5				pH=10.02						Ground water sample 92'
					30.0							
							-94-				94.0-99.0': SILT LOAM; 2.5Y 4/1 dark gray, 83% Silt, 2% round Gravel; 5% fine Sand; 10% Clay, dense, hard, stiff, 3.5" diameter cobble at 94', slightly moist.	
					30.0			95				
14:00	4.0	5				pH=10.28						
					5.0							
							-99-				END OF BORING AT 99' BGS.	

ERM Environmental Resources Management, Inc.

WELL CONSTRUCTION LOG

PROJECT/TASK	PROJECT NUMBER	WELL NUMBER
Soil Boring and Well Installation	71226.02.01	2002



Associated Soil Boring 2002

City Shadeland

County and State Tippecanoe, IN

Ground Surface Elevation 611.20

Measuring Point Elevation 613.21

☒ Surveyed ☐ Estimated

Installation Date (s) 03/19/01-03/22/01

Drilling Method Mobile CME 95

Drilling Contractor Reynolds

Drilling Fluid 50 gallons of water

Development Technique (s) / Dates

Developed well using a Grundfos Redi-Flo2 Pump

April 2001

Fluid Loss During Drilling (gals)

Water Removed During Development (gals)

Static Water Level Depth (feet)

Date Water Level Measured

Well Purpose Monitoring Well/Piezometer

Remarks N 1299.01; E 150.94

The casing and ground surface elevations were measured using Lilly plant datum. The northing and easting coordinates are based on the Lilly plant grid.

Prepared By Christine Tonn

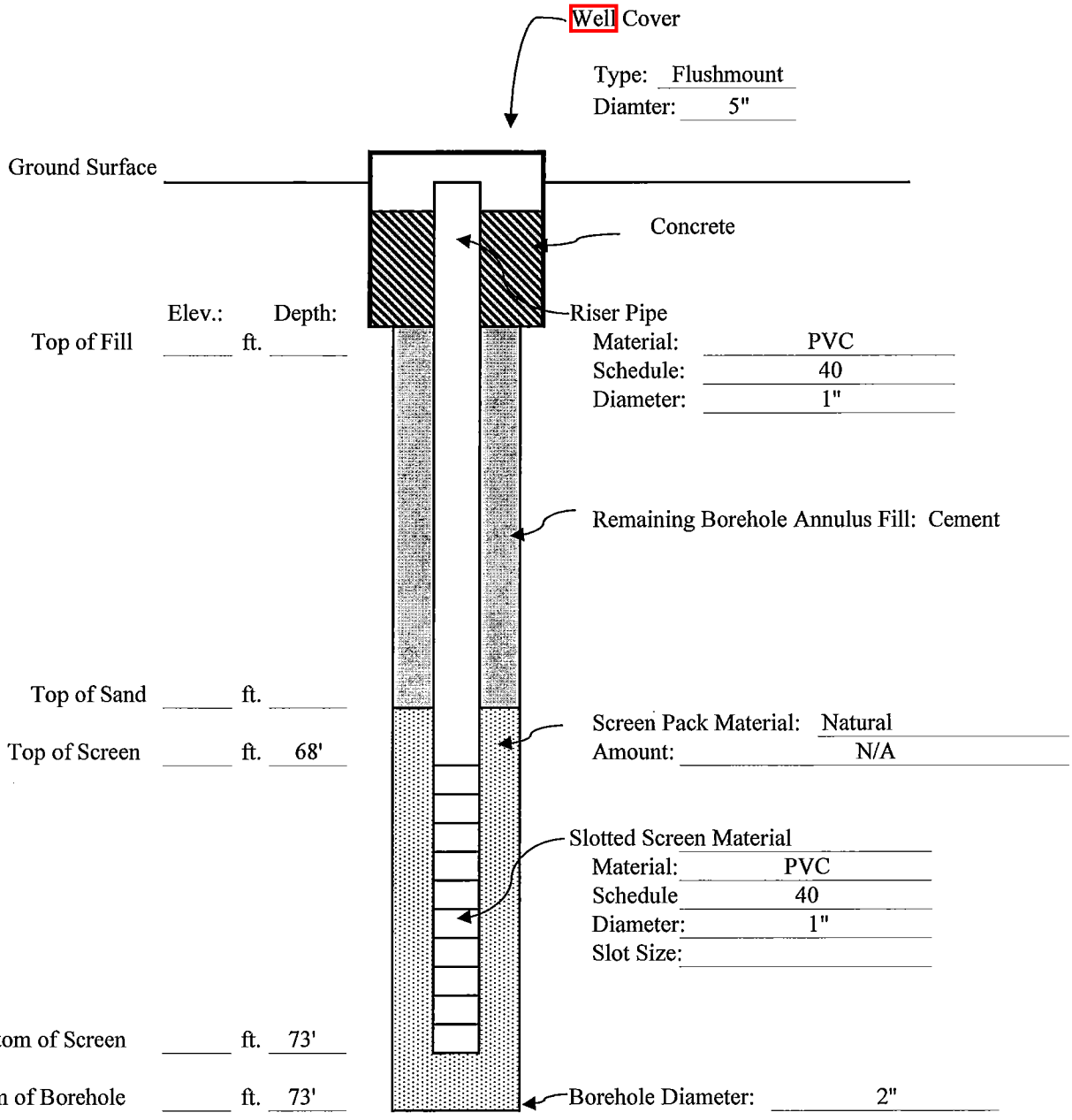
Location Vernon Hills

ERM, Inc.
11350 N. Meridian Street, Suite 220
Carmel, Indiana 46032
(317) 706-2000

Well Construction Diagram

T2011

Client:	Eli Lilly and Company	**Date Installed:**	11/3/2009
Project:	pCBT Investigation	**Development Method:**	Bailer
Proj. No.:	0104376	**Water Removed During Development:**	
ERM Geologist	Craig Eckerle	**Static Water Level Depth/Elevation:**	62.53
Drilling Company:	Reynolds, Inc.	**Northing/Easting:**	504931 / 4470985 (NAD83/WGS84)
Driller:	Lewis Melling	**Top of Casing Elevation:**	NA
Drilling Method:	Geoprobe 6600	**Ground Elevation:**	NA



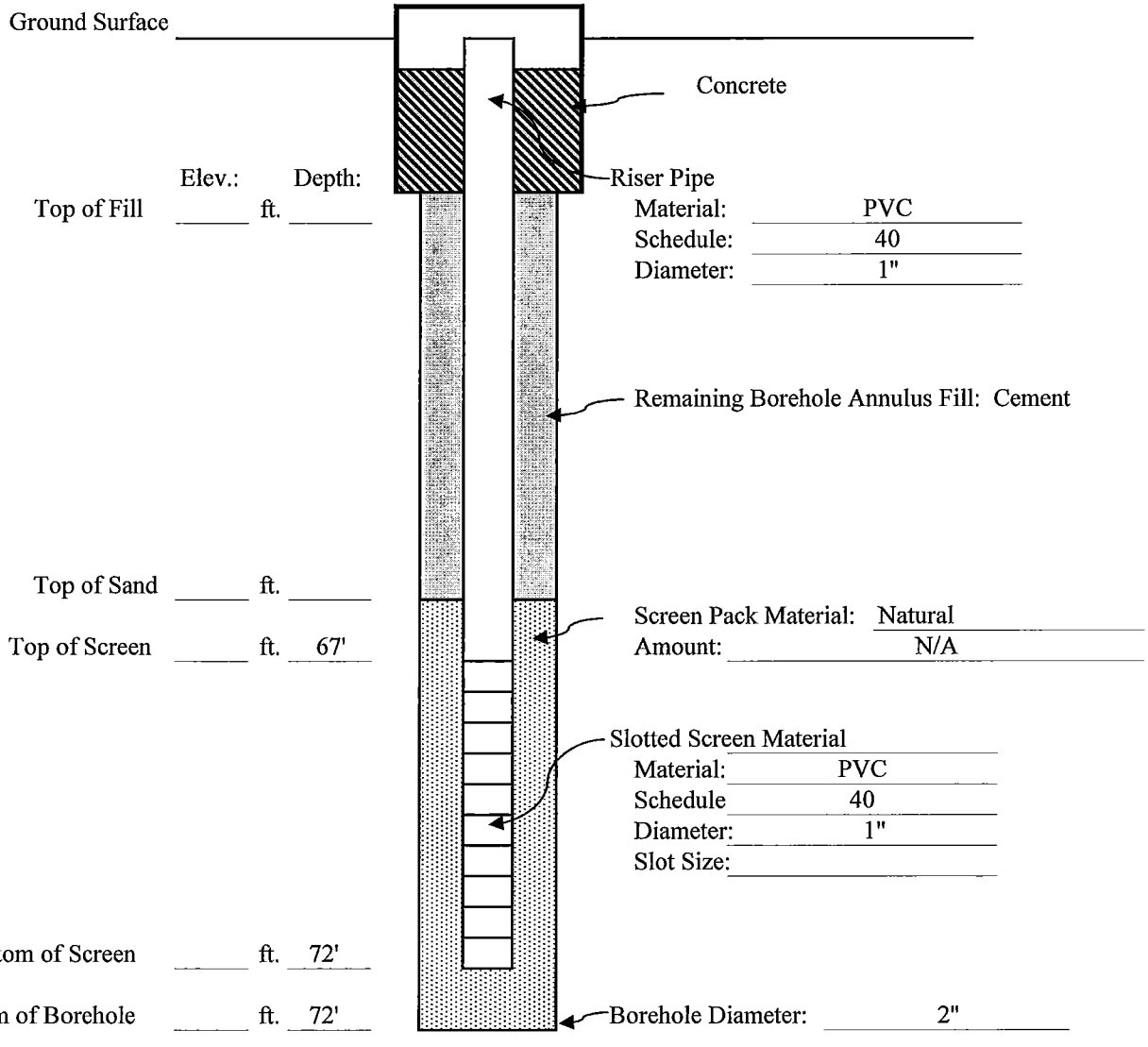
Comments: Well was originally installed as temporary well pCBT-1 then converted to a permenent monitoring well. No soil samples were collected.

ERM, Inc.
11350 N. Meridian Street, Suite 220
Carmel, Indiana 46032
(317) 706-2000

Well Construction Diagram

T2014

Client:	Eli Lilly and Company	**Date Installed:**	11/4/2009
Project:	pCBT Investigation	**Development Method:**	Bailer
Proj. No.:	0104376	**Water Removed During Development:**	
ERM Geologist	Craig Eckerle	**Static Water Level Depth/Elevation:**	62.37
Drilling Company:	Reynolds, Inc.	**Northing/Easting:**	504789 / 4470939 (NAD83/WGS84)
Driller:	Lewis Melling	**Top of Casing Elevation:**	NA
Drilling Method:	Geoprobe 6600	**Ground Elevation:**	NA



Comments: Well was originally installed as temporary well pCBT-5 then converted to a permenent monitoring well. No soil samples were collected.

ERM-North Central, Inc.

Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
T100 Subsurface Investigation	71221.00.01	1 of 5	TSP-5

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1365; E392	Flame Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
7/20/99	7/22/99	Reynolds	Mobile 61 drill rig - 4 1/4 HSA	9-Inches	97'

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	ELEV. TOP CASING	GROUND ELEV.	DEPTH/ELEV. GROUND WATER	DEPTH/ELEV. TOP OF ROCK
/				615		NOT ENCOUNTERED

SAMPLE DEVICE	DRILL CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY
2" x 2' Split Spoon Sampler		Kimberly Lake

SAMPLES/R.CORE				CONTAMINANT SCREENING							DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count / RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations	LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE		
								5				Blind drill to 44' BGS.
								10				
								15				
								20				

ERM

ERM–North Central, Inc.

Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMB
T100 Subsurface Investigation	71221.00.01	2 of 5	TSP-

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1365; E392	Flame Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
7/20/99	7/22/99	Reynolds	Mobile 61 drill rig – 4 1/4 HSA	9-Inches	97'

Continued

SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count / RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations						
								20				
								25				
								30				
								35				
								40				

ERM-North Central, Inc.

Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
T100 Subsurface Investigation	71221.00.01	3 of 5	TSP-5

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1365; E392	Flame Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
7/20/99	7/22/99	Reynolds	Mobile 61 drill rig - 4 1/4 HSA	9-Inches	97'

Continued

SAMPLES/R.CORE: Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count / RQD (%)	CONTAMINANT SCREENING: Sample Scan* (Vppm)	Headspace** (Vppm)	Observations	LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
								40				
TSP5 (44-46) S 1800	1.5	2	11 22 29 37			pH=8.38	-44				44.0-45.0': SAND; 2.5Y 4/3 olive brown to 5/2 greyish brown, v.f.-f Sand, well sorted; loose, slightly moist.	
							-45	45			45.0-45.1': SAND AND GRAVEL; 2.5Y 5/3 light olive brown, 20% Silt on grains, 40% m-v.c. Sand, 40% Gravel to 0.5" diameter, angular to sub-rounded; slightly moist.	
	1.25	2	87 127 - -			pH=8.08	-46				45.1-45.25': SILT LOAM; 50% Silt, 40% v.f. Sand, 10% Gravel; increased compactness, dry.	Blind drill 47-48' BGS due to high blow counts.
							-48.2				45.25-48.0': SAND AND GRAVEL; 2.5Y 5/3 light olive brown, 20% Silt on grains, 40% m-v.c. Sand, 40% Gravel to 0.5" diameter, angular to sub-rounded; odors throughout sample, slightly moist.	
	1	2	37 72 59 38			pH=7.54	-49				Fine to medium Sand.	
								50			47.25-48.2': SAND; 2.5Y 6/3 light yellowish brown to 5/4 light olive brown, 5% Silt on grains, 75% m-c Sand, 20% Gravel, sub-rounded to angular, to 1" diameter; loose, strong odors, dry.	
	1	2	24 65 71 119								2.5Y 5/3 light olive brown f-m Sand, well sorted; loose to friable, slightly moist.	Blind drill 51.3-52' BGS due to high blow counts.
							-52				48.2-49.0": SAND AND GRAVEL; 2.5Y 4/4 olive brown, 10% Silt on grains, 80% m-c Sand, 30% Gravel to 1" diameter, sub-rounded to sub-angular, poorly sorted; slightly moist.	
	1	2	41 181 78 88			pH=7.74						
							-54				49.0-52.0': SAND; 10YR 5/4 yellowish brown with 2.5YR 4/8 red iron staining on grains and in vugs, f-m Sand, well sorted; strong odors, dry.	
	2	2	29 38 170 -	188		pH=7.83		55			Occasional gravel to 0.75" diameter, very strong odors.	Blind drill 55-58.5' BGS due to high blow counts.
											52.0-54.0': SAND; 30% Silt on grains, 45% f-m Sand, 25% Gravel to 1.5" diameter, angular to sub-rounded; loose, dry.	
		2	200+									
TSP5 (58-60) S 1510		2	- 37 29 56	30							54.0-63.1': SAND AND GRAVEL; 10YR 5/3 brown with 7.5YR 5/8 strong brown iron staining in vugs, 20% Silt on grains, 30% f-v.c. Sand, 50% Pebbles to 0.25" diameter, sub-rounded; loose, very strong odors, dry.	
								60			Very strong odors.	

ERM–North Central, Inc.

Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMB
T100 Subsurface Investigation	71221.00.01	4 of 5	TSP-

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1365; E392	Flame Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
7/20/99	7/22/99	Reynolds	Mobile 61 drill rig – 4 1/4 HSA	9-Inches	97'

Continued

SAMPLES/R.CORE: Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count / RQD (%)	CONTAMINANT SCREENING: Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations	LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
		2	79 18 37 88	208				60				
	2	2	37 171 126 –	408		pH=8.40	-83.1-				SAND; decrease in gravel content to 10%. Occasional black vugs, increased compactness. 83.1–84.0': SILT LOAM; 84% Silt, 35% v.f. Sand, 1% Gravel; dry.	
	1	2	3 37 109 117	1550		pH=7.33	-84- -85-	65			84.0–85.0': SANDY LOAM; 2.5Y 4/3 olive brown with some black staining throughout sample, 24% Silt on grains, 75% f-m Sand, 1% small Gravel, sub-rounded; loose, very moist.	Blind drill 85.5–88' BGS due to high blow counts. Wet at 88' BGS.
	1.75	2	13 51 77 89	3200		pH=7.02	-88-				85.0–88.0': SILT; 2.5Y 5/3 light olive brown with 10YR 5/8 yellowish brown iron staining on grains, 15% Clay, 45% Silt, 25% f-m Sand, rounded, 15% Gravel to 0.5" diameter, sub-rounded to angular; moderately soft, moist.	
	2	2	12 11 48 102	4875		pH=8.80	-88-				88.0–88.0': ALTERNATING LOAMY SAND AND SILT LOAM; Loamy Sand consists of 10YR 5/3 brown to 4/1 dark grey, 15% Silt on grains, 84% f-m Sand, 1% Gravel to 0.5" diameter, sub-rounded, Silt Loam consists of 2.5Y 5/2 grayish brown, 70% Silt, 29% f-m Sand, 1% Pebbles, subrounded, to 1/5" diameter.	Odors not as strong as above.
	1.25	2	30 84 – –	1495		pH=7.73	-70.5-	70			88.0–89.5': LOAMY SAND; horizontal laminations in silt. 89.5–70.0': 5Y 4/1 dark grey, clay-rich unit containing 20% f-m sand; hard; strong odors.	Blind drill 71–72' BGS due to high blow counts.
	1.5	2	13 11 18 31	3477		pH=7.52	-72- -72.5- -73.5-				70.0–70.5': SANDY LOAM; 2.5Y 5/3 light olive brown, 40% Silt on grains, 60% f-m Sand, rounded; loose to friable, wet.	Remaining FID readings taken directly from spoon due to low sample recovery.
	1.5	2	12 27 22 32	597		pH=8.24	-74-	75			70.5–72.0': CLAY LOAM; 2.5Y 4/2 dark greyish brown, 35% Clay, 40% Silt, 25% f. Sand; stiff, wet. Increased hardness. 20% f-c Sand, 10% Gravel to 0.25" diameter, sub-rounded to angular; moist.	
	2	2	8 7 28 103	78		pH=8.22					72.0–72.5': SILT LOAM; 50% Silt, 50% f-m Sand, rounded; loose, wet. 72.5–73.5': SILTY CLAY LOAM; 30% Clay, 50% Silt, 20% f. Sand, occasional gravel to 2" diameter; stiff to soft. 73.5–74.0': SANDY LOAM; 35% Silt, 65% f-v.c. Sand, fining downward sequence; loose to friable, wet.	
	1.5	2	19 12 23 42	1894		pH=8.51		80			74.0–87.5': SAND; 2.5Y 5/2 grayish brown, 10% Silt on grains, 90% f-m Sand, wet, sorted, rounded; loose to friable, moderately dense, wet.	

ERM-North Central, Inc.

Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
T100 Subsurface Investigation	71221.00.01	5 of 5	TSP-5

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1365; E392	Flame Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
7/20/99	7/22/99	Reynolds	Mobile 61 drill rig - 4 1/4 HSA	9-Inches	97'

Continued

SAMPLES/R.CORE: Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count / RQD (%)	CONTAMINANT SCREENING: Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations	LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
	2	2	8 35 108 -	1771				80				Blind drill 81.5-82' BGS due to high blow counts.
	2	2	5 22 28 100	949		pH=8.79					1% Gravel to 1" diameter. Increased compactness.	
TSP5 (84-89) GW 1540	2	2	30 88 128 -	1845		pH=8.70		85				Ground water sample collected from temporary screen at 84-89'.
TSP5 (86-88) S 1215	2	2	19 55 109 94	754		pH=8.88	-87.5					
	2	2		101.8			-88				87.5-88.0': SANDY LOAM; 2.5Y 4/2 dark grayish brown, 20% Silt, 80% f. Sand. Shoe contains small amount of clay. 88.0-90.0': SANDY LOAM W/ALTERNATING LAYERS OF SILT LOAM: Silt Loam consists of 10% Clay, 80% Silt, 30% f. Sand; ~2" thick Silt Loam layers, ~6" thick Silt layers, wet.	
TSP5 (90-92) S 1510	2	2	21 41 103 -	174		pH=7.18	-90 -91	90			90.0-91.0': SAND; 10% Silt, 90% f-m Sand, rounded; moderately compact, uncemented, wet.	
	2	2	84 124 118 -	288		pH=9.25	-92 -92.7				91.0-92.0': SILT LOAM; 10% Clay, 80% Silt, 30% f. Sand, clay content increases in alternating layers; hard, plastic, wet. 92.0-92.75': SILT LOAM; 2.5Y 5/2 grayish brown, 25% Clay, 45% Silt on grains, 30% f-m Sand; wet.	
	1.25	3	- - 157					95			92.75-97.0': SILT LOAM; 2.5Y 5/2 grayish brown, 25% Clay, 70% Silt, 5% f-c Sand; hard, odors, wet.	Shelby tube collected 94-97' BGS.
							-97				END OF BORING AT 97' BGS.	
								100				

ERM-North Central, Inc.

Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
T52 Subsurface Investigation	71221.00.01	1 of 4	GP-7

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1444; E404	Flame Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
5/14/99	5/14/99	Paramount	Truck mounted geoprobe	2-Inches	48'

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	ELEV.TOP CASING	GROUND ELEV.	DEPTH/ELEV. GROUND WATER	DEPTH/ELEV. TOP OF ROCK
/				615		NOT ENCOUNTERED

SAMPLE DEVICE	DRILL CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY
2" x 2' Geoprobe Sampler		Jennifer Fry

SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations						
		4			0.0	pH=8.99					0.0-12.0': GRAVELLY SILT LOAM FILL; 10YR 4/3 brown, 80% Silt; 10% Sand, angular to sub-rounded, poorly sorted; 30% Gravel, to 1.5" diameter; medium density, friable, no odors, moist.	Equipment Blank collected.
GP7 (4-8)S 0920		4			0.2	pH=7.15		5			10YR 3/3 dark brown.	
		4						10			10YR 3/3 dark brown, friable, poorly sorted, loose, moist.	
		4									12.0-19.5': LOAMY SAND; 10YR 4/3 brown, 10YR 5/8 yellowish brown iron staining on individual grains, 20% Silt; 40% Sand, poorly sorted, angular to sub-rounded; 40% Gravel; loose, slightly moist.	
								15				

ERM-North Central, Inc.

Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
T52 Subsurface Investigation	71221.00.01	2 of 4	GP-7

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1444; E404	Flame Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
5/14/99	5/14/99	Paramount	Truck mounted geoprobe	2-Inches	48'

Continued

SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count / RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Obser-vations						
		4						15				
		4				pH=8.75					10YR 3/3 dark brown to 10YR 5/8 yellowish brown iron staining on individual grains, gravel to 1" diameter, slightly moist.	
							-19.5-				19.5-20.0': SAND FILL; 10YR 4/3 brown, 5% Silt; 85% Sand, poorly sorted; 10% Gravel to 0.75" diameter; loose, unconsolidated.	
							-20-	20				
		4			0.0						20.0-24.0': SAND FILL; 10YR 5/8 yellowish brown staining on grains, 5% Silt; 65% Sand, poorly sorted, angular to sub-rounded; 30% Gravel, 1.5" thickness of gravel fragments at 23.5' BGS (10YR 7/4).	
							-24-					
								25			24.0-28.0': SAND FILL; 10YR 5/8 yellowish brown, 10YR 8/8 brownish yellow in 5" zone at 25' BGS; 5% Silt; 90% Sand, sub-rounded, poorly sorted; 5% Gravel; low density, moist.	
		4			0.0	pH=7.49	-28-				28.0-38.0': GRAVELLY SAND; Sand content decreases to 85% and gravel content increases to 30%, increased iron staining on individual grains, slightly moist.	
		4			0.0	pH=7.78					10YR 5/8 yellowish brown to 10YR 5/4 yellowish brown iron staining on individual grains, 10YR 5/4 yellowish brown in 4" thickness at 30.2' BGS, 5% Silt; 55% Sand, angular to sub-rounded, poorly sorted; 40% Gravel to 1" diameter; slight non-descript odor, warm 31-32' BGS, loose, unconsolidated, moist.	Slight odors at ~~~ BGS.
								30				

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ERM–North Central, Inc.

Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
T52 Subsurface Investigation	71221.00.01	3 of 4	GP-7

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1444; E404	Flame Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
5/14/99	5/14/99	Paramount	Truck mounted geoprobe	2-Inches	48'

Continued

SAMPLES/R.CORE: Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count / RQD (%)	CONTAMINANT SCREENING: Sample Scan* (Vppm)	Headspace** (Vppm)	Observations	LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
		4			0.0	pH=7.78		30				
GP7 32-36)S 1010		4			11.2	pH=8.55		35			Gravel to 1.5" diameter at 32' BGS, alcohol-like odor.	Alcohol-like odors at 32' BGS.
		4			35.2	pH=7.90	-36	40			36.0–42.0': SAND; 2.5Y 5/3 light olive brown, 5% Silt, 93% Sand, medium grained, moderately well sorted; 2% Gravel; alcohol-like odor, increased temperature, moist.	Increased temperature and alcohol-like odors at 36' BGS.
		4			29.9	pH=7.82	-42				5Y 8/1 grey, 5% Silt; 85% Sand, angular to sub-rounded, poorly sorted, medium to coarse grained; 10% Gravel; no iron staining, loose, slightly moist.	
							-42.3				5Y 8/2 horizontal iron staining, fine grained, well sorted, loose, unconsolidated, moist.	
											42.0–42.3': SILT; 90% Silt; 10% very fine Sand; very dense, moist.	
											42.3–44.0': SANDY LOAM; 5Y 5/1 grey, 50% Silt, 50% Sand, well sorted; medium density, loose.	
GP7 44-48)S 1120		4			44.0	pH=8.98	-44	45			44.0–45.0': SILT; 5Y 8/2 light olive grey, 80% Silt; 20% Sand, very fine grained, well sorted; medium density, moist.	

ERM

ERM–North Central, Inc.

Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT/TASK	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
T52 Subsurface Investigation	71221.00.01	4 of 4	GP-7

SITE	COORDINATES	CONTAMINANT SCREENING NOTES
Eli Lilly, Shadeland, IN	N 1444; E404	Flame Ionization Detector

BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT	BORING DIA.	DEPTH (FT)
5/14/99	5/14/99	Paramount	Truck mounted geoprobe	2-Inches	48'

Continued

SAMPLES/R.CORE: Lab Sample # / Time	Recovery (feet)	Length (feet)	Blow Count / RQD (%)	CONTAMINANT SCREENING: Sample Scan* (Vppm)	Headspace** (Vppm)	Observations	LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
GP7 (44-48) S 1120		4			44.0	pH=8.86		45			~~45.0-48.0': SANDY LOAM; 10YR 6/2 light~~ brownish grey to 10YR 6/4 light yellowish brown, poorly sorted, medium grained to gravel, iron staining on grains. 4" thickness of 5Y 5/2 olive grey, 70% Silt; 30% Sand, very fine grained, well sorted; medium density, slightly moist.	
							-48-				END OF BORING 48' BGS.	
								50				
								55				
								60				

ERM, Inc.
11350 N. Meridian Street, Suite 220
Carmel, Indiana 46032
(317) 706-2000

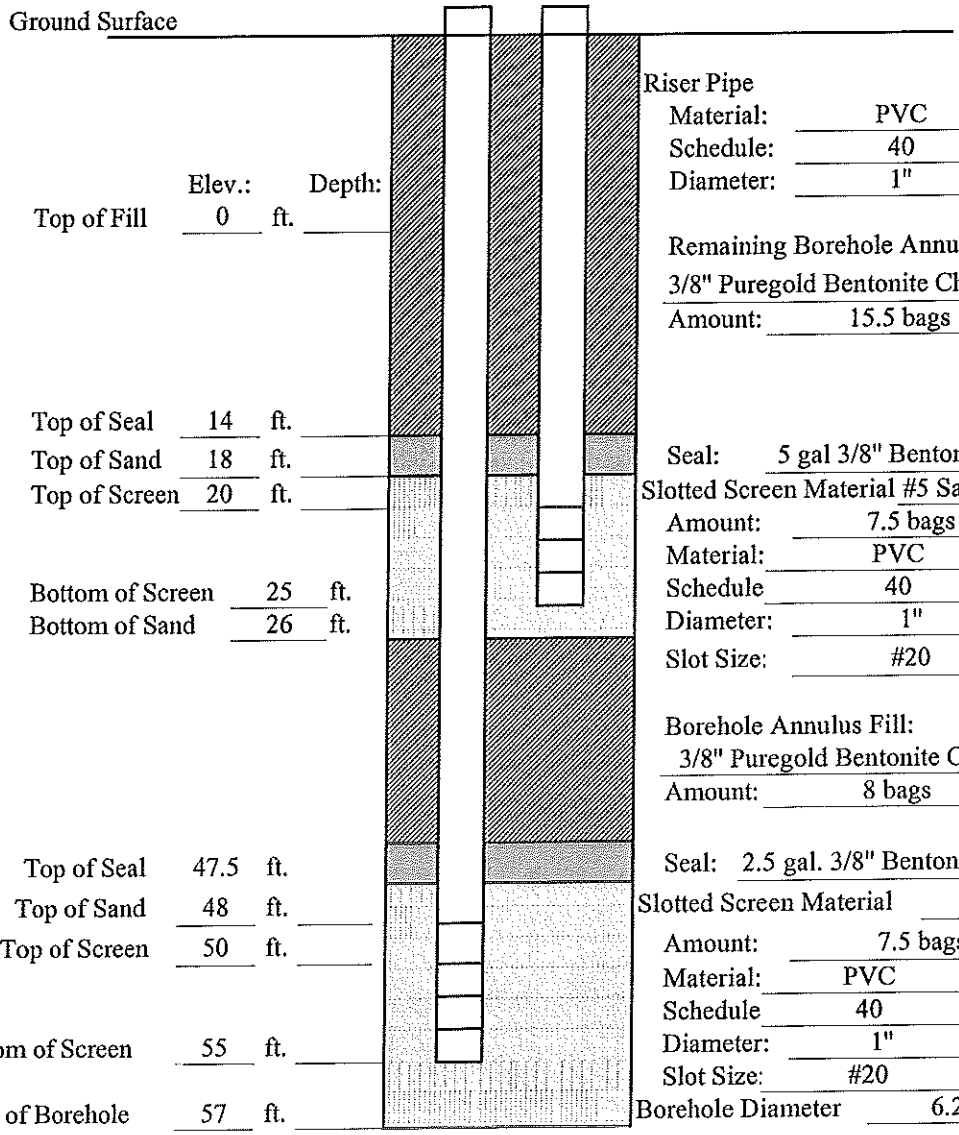
Well Construction Diagram

Well Identification: MT-4a/b

Client: Eli Lilly
Project: SVE Pilot Test
Proj. No.: 0004213
ERM Geologist Andy Wallace
Drilling Company: Reynolds, Inc.
Driller: Chris Boulet
Drilling Method: 6.25" HSA

Date Installed: 7/21/03
Date Developed:
Development Method:
Water Removed During Development:
Static Water Level Depth/Elevation:
Top of Casing Elevation:
Ground Elevation:

Protective Steel Casing and Lock
Type:
Diameter



Elev.: Depth:

Riser Pipe
Material: PVC
Schedule: 40
Diameter: 1"

Remaining Borehole Annulus Fill:
3/8" Puregold Bentonite Chips
Amount: 15.5 bags

Seal: 5 gal 3/8" Bentonite Pellets
Slotted Screen Material #5 Sand
Amount: 7.5 bags
Material: PVC
Schedule 40
Diameter: 1"
Slot Size: #20

Borehole Annulus Fill:
3/8" Puregold Bentonite Chips
Amount: 8 bags

Seal: 2.5 gal. 3/8" Bentonite Pellets
Slotted Screen Material #5 Sand
Amount: 7.5 bags
Material: PVC
Schedule 40
Diameter: 1"
Slot Size: #20
Borehole Diameter 6.25"

SOIL BORING LOG

HES HARZA ENVIRONMENTAL SERVICES, INC.

Sheet 1 of 5

PROJECT: ELI LILLY TIPPECANOE LABS

Location of Boring: SEE TS2-2

Water Depth: 65.5'
Date: 11/2
Time: —
Hole Depth:
Casing Depth:

Boring No.: TS2-1
Feature: TS2 TANK FARM
Coordinates: N
E
Ground Elevation: ~612
Casing Elevation: NA
Total Depth: 94½'
Bottom Elevation:

Drilling Method (s): 4¼" ID HSA
Hole/Casing Size (s):

Date Started: 11/1/90 Time: 1445
Date Completed: 11/2/90 Time: 1230

Logged By: D. WALLER Checked By: T. PYBUS Date: 12/4/90
Drilling Contractor: TSC

Sampling Method (s): SPT on 2½', 11.7eV HNU, MX241 for %LEL
SAMPLES MARKED * TO LILLY FOR ANALYSIS
Sample Dimensions: 18"x1.3"ϕ Hammer Weight/Drop: 130# / 36"
Surface Conditions: Dry crushed LS gravel

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS BCKGND (N) HNU (ppm)	REMARKS BCKGND (N) LEL (%)
1		1	8 3 4	18"	8"				FILL: brn silty gravelly SAND, loose	0.2 (0.2) DRY 1450	
2											
3											
4		2	5 6 8	18"	16"				FILL: rd-brn silty gravelly SAND, loose	0.4 (0.4) DAMP 1455	—
5											
6											
7		3	5 2 4	18"	10"				FILL: red-brn gravelly SAND w/silt, loose	0.2 (0.2) DAMP-WET 1505	0 (0)
8											
9		4	4 3 2	18"	12"				FILL: as above	0.4 (0.4) DAMP-WET 1510	—
10											
11											
12		5	3 3 3	18"	8"				FILL: rd-brn gravelly clayey SAND (w/silt?), loose	0.6 (0.6) MST-DAMP 1515	—
13											
14		6	5 8 13	18"	12"				FILL: rd-brn gravelly silty SAND loose. lrg gravels	0.4 (0.4) DAMP 1520	0 (0)

SOIL BORING LOG
(Continued)

HESHARZA ENVIRONMENTAL SERVICES, INC.

Sheet 2 of 5

PROJECT: ELI LILLY TIPPECANOE LABS Boring No.: TS2-1

Sampling Method(s): (see page 1/)

Sample Dimensions: _____ Hammer Weight/Drop: _____ / _____

Surface Conditions: _____

Drilling Contractor: TSC Logged By: D.D. WALKER Checked By: J. PYRICH Date: 12/4/90

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
										16': UNIT I
16		7	16 18 30	18"	18"		SP		Dense, vf~crs gravelly SAND, poorly grdd. FeO2 Staining trc fines	0.4(0.4) 0(0) DAMP 1520
17										
18										
19		8	17 18 24	18"	18"		SP		Dense, vf~crs SAND, trc sm gravel, trc fines, poorly gradd.	0.4(0.4) DAMP
20										
21										
22										
23										
24		9	19 21 25	18"	18"				As above	— DAMP
25										
26										
27										
28										
29		10	100/6"	6"	4"		SM		Dense, vf~crs silty SAND, trc sm. sbrnd gravel, mod grdd	0.9(0.9) WET-DMP 1556
30										
31										
32										
33										
34		11	14 20 18	18"	18"		SM		Dense, vf~crs silty gravelly SAND, mod ~ well grdd	1.0(1.0) DMP

SOIL BORING LOG
(Continued)

HESHARZA ENVIRONMENTAL SERVICES, INC.

Sheet 3 of 5

PROJECT: ELI LILLY TIPPECANOE LABS

Boring No.: T52-1

Drilling Contractor: TSC | Logged By: D.D.WALLER | Checked By: T. PYRICH | Date: 12/4/90

Sampling Method(s): (see page 1/5)

Sample Dimensions: _____ Hammer Weight/Drop: _____ / _____

Surface Conditions: _____

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
36										
37		12	15 17 21	18"	16"		SW		Dense, rd-brn f~crs SAND w/gravel, trc silt. Well grdd	1.0(1.0) 0(0) DAMP 1610
38										
39		13	14 22 16	18"	14"		SW		Dense, rd-brn f~crs SAND w/gav, trc silt. Well grdd. Rndd 3/4" gravel	1.0(1.0) — DAMP 1615
40										
41			10							
42		14	11 12	18"	16"		SP		Dense, gr-brn f~crs SAND and gravel, trc fines. Poorly grdd, 1/2" rndd gravel	1.0(1.0) 0(0) DAMP 1620
43										
44		15	24 24 26	18"	16"		SP		Dense, gr-brn f~crs SAND w/gravel, trc fines, mod gradd. 1/2" rndd gravel	1.0(1.0) — DAMP 1625
45										
46			14							
47		16	20 22	18"	18"		SP		Dense, grey vf~f SAND, trc silt, v.poorly grdd, trc black staining	0.8(0.8) 0(0) DMP-WET 1630
48									[48~48.75': UNIT IA] Stiff, y-brn SILT, trc f.sand, Black mottling	2.0(0.8) 0(0) MST
49		17	16 25 32	18"	18"		ML SP		Dense grey vf~f SAND, poorly grdd. Black staining	WET SOP 1640 RESUME DRILLING 11/2/90
50										
51			36							1.8(1.8) 0(0)
52		18	36 50/5"	17"	16"		ML		Dense grey f~m SAND, poorly grdd Black staining Firm blackened SILT, trc f.sand	DAMP-WET 0820
53										
54		* 19	37 50/5"	11"	10"		SW		V. Dense f~crs gravelly SAND, trc fines mod grdd. Gr~brn	20.0(1.4) — WET 0825

HESHARZA ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG
(Continued)

Sheet 4 of 5

PROJECT: EU LILLY TIPPECANOE LABS Boring No.: TS2-1

Drilling Contractor: TSC Logged By: D.D. WALKER Checked By: J. RYBICH Date: 12/4/90

Sampling Method(s): (see page 1/5)

Sample Dimensions: _____ Hammer Weight/Drop: _____ / _____

Surface Conditions: _____

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
56										
57		20	24 33 27	18"	18"		SW		Dense, gr-brn vf~crs gravelly SAND, trc fines. Finer in seams, laminae Well grdd.	50.0(1.2) 0(0) DAMP-WET 0835
58										
59		21	35 50/6"	12"	12"		SW		Dense, gr-brn vf~crs gravelly SAND, trc fines. Fine in seams, laminae	80.0~90.0 (1.2) DAMP 0840
60										
61		22	75/5"	5"	5"		SW		Dense gr-brn vf~crs gravelly SAND, trc fines.	150(1.0) DAMP 0850
62										
63										
64		23	20 32 44	18"	16"		SM		Dense brn vf~crs silty SAND w/ gravel.	140(1.4) 0(0) V. WET 0905
65										▽ 65½'
66		*24	36 50/5"	11"	10"		SW		V. Dense, gr-brn vf~crs SAND w/ gravel, well grdd, trc fines	30.0(1.2) SAT 0915
67										
68										
69		25	40 50/6"	11"	10"		SW		V. Dense, gr-brn, vf~crs SAND w/ gravel, well grdd, trc fines	40.0(1.2) SAT 0925
70										
71										
72										
73										
74		26	27 50/4"	12"	10"		SM		V. Dense, gr silty vf SAND, v. poorly graded	30.0(1.2) 0(0) SAT 0930

HESHARZA ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG
(Continued)

Sheet 5 of 5

PROJECT: ELI LILLY TIPPECANOE LABS Boring No.: T52-1

Drilling Contractor: TSC Logged By: D.D. WALKER Checked By: T. PYRICH Date: 12/4/90

Sampling Method(s): (see page 1/5)

Sample Dimensions: _____ Hammer Weight/Drop: _____ / _____

Surface Conditions: _____

Boring Depth (ft/m)	Sample Depth (ft/m)	Sample No.	Blows per 6 in/15 cm	Length Driven (in/cm)	Length Recovered (in/cm)	Graphic Recovery	Unified Soil Classification	Graphic Log	SOIL DESCRIPTION	REMARKS
76										
77										
78										
79	5	27	18 38 50/6"	18"	18"		SM		V. dense, grey vf~f SAND w/silt, trc sm. gravel.	7.0 (1.2) SAT 0950 —
80										
81										
82										
83										
84	.5	26	8 20 35	18"	18"		SP		V. dense, grey vf~f SAND, no fines trc. sm. gravel (6"+ blow-up)	10.0(1.2) SAT 0(0) 0955
85									(2'+ blow-up)	
86		29	36 50/6"	12"	12"		SP		X. dense grey vf~f SAND, no fines	7.0(1.2) SAT 0(0) 1100
87										
88									(2' blow-up)	
89		30	16 20 50/3"	15"	15"		SP		V. dense grey vf~ med SAND, no fines, trc sm. gravel. Strong decay odor.	12.0(2.2) SAT 0(0) 1120
90										
91		31	90/6"	6"	4"		SM		(5' blow-up) X. dense vf SAND w/silt, lrg LS gravel frag, strong decay odor	100.0(2.2) SAT 0(0) 1155
92										93½': UNIT II
93										
94		* 32	31 50/6"	12"	12"		CL		X. dense grey silty CLAY w/sand some sm sbrnd. gravel. (TILL) Strong decay odor.	10.0(2.2) SAT-MST 0(0) 1215
					*		94½': EOB			Backf. w/cuttings

ATTACHMENT 2
TRAVEL TIME CALCULATIONS

T1855 Area		
Hydraulic Conductivity, ft/min	0.06	(1989 Harza Report)
Porosity	0.3	(1989 Harza Report)
Assumed saturated thickness, feet	1.5	(Based on conceptual design)
Volume injected in each well, gallons	260	(Based on conceptual design - 250 gallons of solution, 10 gallons of clean water)
Injection Rate, gpm	5	(Based on conceptual design)
Pumping Time, hours	0.9	(Based on conceptual design)
Radius of chemical influence At End of Pumping, ft	5.0	Calculated
Natural Hydraulic Gradient, ft/ft	0.003	(Based on Q2 2010 Potentiometric Map)
Distance to Monitoring Well T2011, feet	5	
Distance to New Monitoring Well #1, feet	30	
Distance to New Monitoring Well #2, feet	60	
Travel Time to Monitoring Well T2011, Days	**0.04**	
Travel Time to New Monitoring Well #1, Days	**25**	
Travel Time to New Monitoring Well #2, Days	**56**	

Floodplain Area		
Hydraulic Conductivity, ft/min	0.008	(1989 Harza Report)
Porosity	0.35	(Adjusted based on silty sand and gravelly sand in saturated zone)
Assumed saturated thickness, feet	20	(Based on conceptual design)
Volume injected in each well, gallons	300	(Based on conceptual design - 250 gallons of solution, 50 gallons of clean water)
Injection Rate, gpm	5	(Based on conceptual design)
Pumping Time, hours	1.0	(Based on conceptual design)
Radius of chemical influence At End of Pumping, ft	1.4	Calculated
Natural Hydraulic Gradient, ft/ft	0.05	(Based on Q2 2010 Potentiometric Map, but is highly variable based on river stages)
Distance to Monitoring Well T1831, feet	10	
Distance to Monitoring Well T1832, feet	100	
Distance to Monitoring Well T1833, feet	100	
Distance to Monitoring Well T1834, feet	50	
Distance to Monitoring Well T1876, feet	120	
Travel Time to Monitoring Well T1831, Days	**5**	
Travel Time to Monitoring Well T1832, Days	--------	Since T1832 is located up-gradient, likely no response will be seen, but flow direction may be reversed due to river
Travel Time to Monitoring Well T1833, Days	**58**	
Travel Time to Monitoring Well T1834, Days	**29**	
Travel Time to Monitoring Well T1876, Days	--------	Since T1876 is located up-gradient, likely no response will be seen, but flow direction may be reversed due to river

Main Plant Area		
Hydraulic Conductivity, ft/min	0.06	(1989 Harza Report)
Porosity	0.3	(1989 Harza Report)
Assumed saturated thickness, feet	18	(Based on conceptual design)
Volume injected in each well, gallons	2800	(Based on conceptual design - 2,750 gallons of solution, 50 gallons of clean water)
Injection Rate, gpm	5	(Based on conceptual design)
Pumping Time, hours	9.3	(Based on conceptual design)
Radius of chemical influence At End of Pumping, ft	4.7	Calculated
Natural Hydraulic Gradient, ft/ft	0.009	(Based on Q2 2010 Potentiometric Map, but note treatment area is located on groundwater divide area)
Distance to Monitoring Well T1818, feet	50	
Distance to Monitoring Well T1908, feet	50	
Distance to Monitoring Well T1814, feet	65	
Distance to Monitoring Well T1808, feet	100	
Travel Time to Monitoring Well T1818, Days	**19**	
Travel Time to Monitoring Well T1908, Days	**19**	
Travel Time to Monitoring Well T1814, Days	**25**	
Travel Time to Monitoring Well T1808, Days	**39**	

Pumping Well T1880		
Pumping Time prior to injection, days	5	
Pumping Rate, gpm	1	(Data Provided by Lilly)
Water Depth During Pumping (ft below TOC)	68	(Data Provided by Lilly)
Water Table Elevation at T1880 During Pumping	547	
Water Table Elevation at T1880 W/O Pumping	553	(Based on Q2 2010 Potentiometric Map)
Drawdown at Well, ft	6	
Total Well Depth (ft below TOC)	76	(Data Provided by Lilly)
T1880 Wellbore Diameter (in)	6	(Boring Log)
T1880 Screened Interval (ft)	5	(Boring Log)
Distance Between Inject. Point and T1880 (ft)	50	
Specific Yield	0.25	(Fetter)
Pumping Hydraulic Gradient, ft/ft	0.120	
Travel Time to Pumping Well T1880, Days	**1.7**	
Radius of Influence at 5 days, feet	**216**	
Drawdown at 5 days at injection point:		
uB	0.0201	
1/uB	49.7664	
Type Curve	7.7	
W	6.13	
Drawdown at Injection Point	0.06	